Metals in Soil and Vegetation in the Sudbury Area (Survey 2000 and Additional Historic Data)

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Acknowledgments

Many people from the Ministry of the Environment contributed to the collection of the data that went into the production of this report. Prior to 1996, studies of the terrestrial environment in the Sudbury area were conducted by scientists from the Ministry's Northern Region, Sudbury District Office. From 1996 onward the responsibility for terrestrial monitoring province-wide was assumed by Phytotoxicology scientists of the Standards Development Branch, Ecological Standards and Toxicology Section. The scientists and technicians at the Ministry's Laboratory Services Branch analyzed the many thousands of samples collected from the Sudbury area over the years.

The principal author of this report is Laura Morra. Randy Jones prepared the maps. Project management was provided by George Crawford and Dave McLaughlin.

A special acknowledgment is owing to Bill McIlveen. Bill McIlveen prepared the first draft of this report, but retired from public service before the project was completed. Bill had a special fondness for the Sudbury area and his extensive personal and professional studies spanning more than two decades have contributed significantly to our current understanding of the impact of the mining industry on the terrestrial environment of the Sudbury basin. Good luck Bill, and thanks.

Purpose of This Report

This report has four specific objectives:

1) to publish the results of the Ministry's most recent soil and vegetation sampling programs in the Sudbury area;
2) to report some previously unreleased Ministry Sudbury soil and vegetation chemistry data and to clearly identify by reference previously published data;
3) to assess the soil and vegetation contaminant levels in the Sudbury area against existing Ministry environmental quality guidelines; and
4) to identify the need for further investigations and assessments in the Sudbury area.

The data summarized in this report spans the period 1971 to 2000. Some previously unreported data from 1971-1999, is included here to ensure all MOE data is available. Data from other historic Sudbury environmental investigations are referenced in this report, however they are stand-alone companion documents and are not discussed in detail in this report. To facilitate reading of this document, details regarding protocols on sampling methodology, preparation, and analyses have been referenced or provided as appendices. Technical reviewers can obtain these protocols from the reference documents.

All data in this report were obtained from samples collected from several Ministry surveys designed to evaluate impacts on the terrestrial environment of the historic and on-going base-metal smelting and refining operations within the Greater Sudbury area.

Data from annual collections of vegetation chemistry reflects changes in air quality over the last 30 years, whereas soil chemistry reflects how air contaminants have accumulated in soil in the Sudbury area over more than 100 years of mining, smelting, and refining activities. In the past, measurements of contaminants in vegetation were used by the Ministry as a measure of air quality, but these high historical concentrations do not reflect the improved environmental conditions that exist today. In contrast, the accumulation of contaminants in the soil is of significant current interest. The MOE is using these data as a planning tool to help determine where the important data gaps are and therefore where future soil sampling efforts should be focused. Much more soil sampling will be done over the next few years, both by the Ministry and by the major mining companies, to fill these knowledge gaps and refine our understanding of soil metal levels in the Sudbury area.

It is also important to realize that this report is not intended to provide an exhaustive interpretation of the implications of the vegetation and soil chemistry in the Sudbury area. Although it is obvious that historic vegetation damage and recent recovery has occurred in the Sudbury area and that soil metal levels are now elevated, it is important that more sampling be done to determine both the extent and severity of soil metal levels in the communities before a thorough evaluation of their potential effects can be undertaken. Although not the focus of this report, the data contained here as well as the data from essential additional sampling currently in progress will allow for an ecological and human health risk assessment to be conducted specifically for the Sudbury communities.

Executive Summary

Environmental impacts of historical emissions of sulphur dioxide and heavy metals from the Inco Ltd. and Falconbridge Ltd. smelters in Sudbury have been well documented. Local and provincial governments, university researchers, and industry have done extensive monitoring, assessment, and reporting on the environmental impacts on terrestrial and aquatic ecosystems.

This report summarizes the previously unreported extensive soil and vegetation chemistry data from the *Sudbury Regular Survey*, the *Sudbury Special Survey*, and the *Year 2000 Surface Soil Survey*. These surveys were conducted in the Greater Sudbury area by the Ministry of the Environment during the period 1971 to 2000. Additional details regarding these surveys are provided in the report.

The study concludes that extensive sampling of soil and vegetation has illustrated elevated levels of heavy metals (specifically nickel, copper, cobalt and to a lesser extent, selenium) and arsenic are common in the Sudbury area. They are particularly elevated in the vicinity of the three historic smelting centres of Copper Cliff, Coniston, and Falconbridge, as well as, the historic roast yards. Apart from the roast yards [11], the highest concentrations in soil consistently occur in the top-most layer of the soil, usually 0-20 centimetres in depth. This indicates air emissions are the source of the contamination. Even though many samples have been taken several times over the last 30 years, it is not possible with this data set alone to confidently identify contaminant trends over time due to changes in laboratory procedures, the uncertainty that precisely the same site was sampled, and the natural variability of these contaminants in soil.

Soil levels are compared to the Ministry's Guideline For Use at Contaminated Sites in Ontario (1996). The MOE soil clean-up *Guidelines* have been developed to provide guidance for cleaning up contaminated soil. The *Guidelines* are not legislated regulations. Also, the *Guidelines* are not action levels, in that exceeding the level does not automatically mean that a clean-up must be conducted. The *Guidelines* were prepared to help industrial property owners decide how to clean-up contaminated soil when property is sold and/or the land-use changes. The value of the *Guidelines* to the Sudbury area report is to provide triggers that may suggest the need for additional investigation or assessment of soil contamination.

This study also concludes that additional sampling is required to achieve five objectives:

1) determine the soil metal and arsenic levels in residential communities adjacent to the smelting centers;
2) determine the soil metal and arsenic levels in industrial lands adjacent to residential communities;
3) contribute to the development of an ecological and human health risk assessment for the Sudbury area communities;
4) determine if the natural background levels of these contaminants are higher in the Sudbury basin due to the presence of base metal ore bodies; and
5) determine the true geographic extent of the metal and arsenic atmospheric deposition, based on the natural background levels.

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I. INTRODUCTION

The impacts of historical emissions of sulphur dioxide and heavy metals from the Inco Ltd. and Falconbridge Ltd. smelters in the Sudbury area are well known [3, 5, 21, 23]. Extensive monitoring and assessment of the environmental impacts on terrestrial and aquatic ecosystems has been conducted by local and provincial governments, university researchers, and industry. Early MOE investigations, conducted by the former Northern Region Sudbury District Office, focused on the effects of sulphur dioxide on vegetation [6, 7, 10, 14]. The incidence of acute vegetation injury caused by this gas has declined [1, 9, 13, 16] and the benefits of reductions in sulphur emissions are evident in the extent of vegetation recovery in the Sudbury area. More recently, increasing emphasis has been placed on the accumulation of heavy metals in soil, particularly copper and nickel, and their associated environmental effects [2, 8, 11, 12, 17, 18, 20, 22, 25].

Since 1996, the Ecological Standards and Toxicology Section (formerly the Phytotoxicology Section) of the Standards Development Branch has been responsible for terrestrial environmental monitoring in the Sudbury area, with an emphasis on delineating the zone of soil contamination. Improvements in air quality, in conjunction with land reclamation efforts, have significantly improved the extent of vegetation recovery in the most severely impacted areas [3, 4, 21].

This report summarizes the previously unreported extensive soil and vegetation chemistry data from the Ministry's *Sudbury Regular Survey*, the *Sudbury Special Survey*, and the *Year 2000 Surface Soil Survey* that were conducted in the Greater Sudbury area during the period 1971 to 2000. Although some of the earlier vegetation data have been summarized in previously released MOE reports [18], this is the first time that unreported historic soil and vegetation data has been collated with the most recent data and evaluated to illustrate the regional distribution of contaminants in surface soil. These data form the basis of an understanding of the extent and severity of surface soil heavy metal contamination associated with the mining industries in Sudbury. In addition, the data and interpretation against the Ministry *Guideline*, provide essential guidance for where additional sampling and assessment is required.

Information relating to the roast yards that operated historically in the Sudbury area has been previously published in 1998 [11], and has not been incorporated into this report. In addition, this report does not include sporadic data from soil and/or vegetation sampling that was conducted in response to complaint investigations on private residential properties. Information collected on private residential properties is privileged to the property owner, and all complaint investigation reports have been completed and provided to the complainants.

II. FIELD INVESTIGATIONS

The soil and vegetation data discussed in this report originated from three integrated but separately structured surveys: 1) the *Sudbury Regular Survey*, 2) the *Sudbury Special Survey*, and 3) *Year 2000 Surface Soil Sampling.*

1) The *Sudbury Regular Survey* consisted of a set of 21 widely-distributed sample sites

(Appendix B - Figure 1). Monitoring activities in this project were periodically revised with respect to sampling frequency and species sampled. The locations of sample sites for the *Sudbury Regular Survey* reflect the program's original objective, which was (primarily) to monitor the impacts of gaseous pollutants (i.e., SO_2) emitted from the older smelter operations on sensitive species of vegetation in the Sudbury region. Therefore the sample sites tended to be spread over a large area. The monitoring was initiated in 1970 prior to the commissioning of the Inco superstack in 1973. Data resulting from this sampling program from 1970 to 1984 have been previously published [18], hence only the results from the 1999 sampling are presented in this report.

2) The *Sudbury Special Survey* was initiated in 1971, also before the superstack became operational. The sampling design followed a structured protocol whereby up to 92 sample sites were established along the cardinal compass directions at increasing distances from each of the three smelting centres of Copper Cliff, Coniston, and Falconbridge. Although the sample sites were focused on the three centres of production, some sites extended out to 30 km distance. None of the *Sudbury Special* data has been previously published, therefore all data is summarized in this report.

3) The *Year 2000 Surface Soil Survey* is the most recent work. The soil data from the *Sudbury Regular* and *Sudbury Special* surveys were combined to identify preliminary data gaps and served as the basis for the additional sampling at 103 sites, that was carried out in 2000.

During these on-going soil and vegetation surveys, the sample preparation method, the analytical methodologies, and the laboratory detection limits changed around 1984. These changes were a result of analytical equipment acquisition and implementation of improved laboratory quality control and assurance protocols by the MOE. More detailed information relating to changes in analytical precision, accuracy, reliability, reproducibility, validity, sensitivity and/or potential for errors is provided in Appendix D. Due to the change in sample preparation and improvements made to analytical methods and detection limits, data from the same site cannot be confidently compared over time. In addition, early sample sites did not benefit from the precision of geo-referencing technology available today and so subsequent samples may not have been collected from precisely the same sites, which further erodes the confidence of time-trend data. In consideration of these changes, it is believed that data presented within this report provides a reasonably accurate picture of current and historic soil contaminant conditions in the Sudbury area.

Following 1984, all processed samples were forwarded to the MOE Laboratory Services Branch where they were analyzed for aluminum(Al), barium (Ba), beryllium (Be), cadmium (Cd), calcium (Ca), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe), lead (Pb), manganese (Mn), magnesium (Mg), molybdenum (Mo), nickel (Ni), strontium (Sr), vanadium (V), and zinc (Zn) using the MOE Laboratory Services Branch accredited analytical method E3073L1. Antimony (Sb), arsenic (As), and selenium (Se) were analyzed using the MOE Laboratory Services Branch accredited analytical method E3245L1. Nickel, copper, cobalt, selenium and arsenic were the elements of interest for analysis based on historic knowledge of the smelting industry and the contaminants that are produced during operation. Due to improvements in analytical equipment and procedures, results for more than 20 metals can be acquired simultaneously during the ICP-AES metals scan.

All data in this report are dry weight totals, that is, the maximum amount of each element that can be leached by the acid used by the laboratory to prepare the sample for analysis. Determining total concentrations in soil and vegetation samples is the Ministry's standard operating procedure. Contaminant speciation and bioavailability tests were not undertaken on the soil samples used in this report. When the proposed 2001 soil sampling programs are complete, and a better understanding of the extent of the soil metal levels in the Sudbury area is obtained, then selected samples will be submitted for speciation and bioavailability analysis.

Interpretation of the soil and vegetation chemistry was based on comparisons with data from the control locations at Blind River and Mattawa as well as with MOE guidelines. Vegetation data were compared with *Upper Limit of Normal* (ULN) Guidelines established in 1989 [19] (Appendix G). Soil data were compared with Tables A and F of the *Guidelines for Use at Contaminated Sites in Ontario,* established in 1997 [21] (Appendix E) or the *Ontario Typical Range* (OTR_{93}) established in 1993 [20] (Appendix F) where soil guidelines were not available. All results are reported as dry weight concentrations in µg/g (micrograms/gram, or ppm, parts per million).

The Table F criteria represent background soil concentrations obtained from an MOE province-wide parkland sampling program. Concentrations that exceed the Table F criteria are usually indicative of a pollution source. The Table A criteria are the concentrations that must be met when a contaminated property is cleaned up for the purpose of residential or parkland re-development. The Table A criteria are effects-based and were derived to protect both human and ecological health, whichever is potentially affected at the lowest concentration. For example, the current Table A criterion for lead is 200 µg/g which was set to protect children from the potentially harmful effects of long-term exposure to lead. The criterion for nickel is 150 µg/g, but this is set to protect sensitive plant species because plants are affected at lower soil nickel levels than it takes to affect human health. Table A criteria are not available for all chemical parameters, since for some elements there is insufficient scientific information available to establish effects-based values (e.g. strontium), or the element is considered non-toxic even at relatively high concentrations (e.g. iron), or the element is a plant nutrient (e.g. magnesium). A summary of the Table F, Table A, OTR_{98}, and ULN guidelines used in this report is provided in Appendix H.

A. Sudbury Regular Survey 1999

In July, 1999, Phytotoxicology scientists of the MOE Standards Development Branch, Ecological Standards and Toxicology Section, collected samples of soil and vegetation at the 21 previously established sample sites of the *Sudbury Regular Survey*. The location of these sample sites are illustrated in Figure 1 (Appendix B). Most of the sites were initially selected in 1970, with additional sites added in 1972 and 1973.

Soil, birch foliage, and grass forage were collected at each location in 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1979, 1984, and 1999. Since 1993, standardized soil sampling procedures were utilized [15]. *Sudbury Regular Survey* data current to 1987 have been previously published [18], therefore, only the most recent data from soil sampling conducted in the summer of 1999 is included in this report.

B. Sudbury Special Survey 1971- 1997

The *Sudbury Special Survey* was initiated in 1971. In that year, soil, trembling aspen foliage, and forage grass was collected (as available) at 92 sample locations (Appendix C - Maps 1 and 2). The sample sites were located along transects on the cardinal compass directions from each of the three smelters operating at that time (Copper Cliff, Coniston, and Falconbridge). Some allowance was made for accessibility via the existing road network, but a number of sites were located in places that could only be reached by hiking overland. To the extent possible and practical, sample sites were positioned 0.5, 1, 2, 3, 4, 5, 10, 15, 20, and 25 miles from the smelters along the north, south, east, and west transects. Because of the relative positions of the smelters, the sample locations coincided along the east-west transect between Copper Cliff and Coniston, and along the north-south transect between Coniston and Falconbridge.

The sampling was repeated in 1976, 1981, 1992 and 1997. Over time, some sample sites were lost to changing lands use, such as construction of houses or other buildings associated with urbanization, road relocation, or closure of road or properties to public access. By 1997 the number of sample sites in the *Sudbury Special Survey* was reduced to 63.

Notably, vegetation was not available at all sites in 1971 but small trees and forage were sufficiently abundant at all sample sites in the more recent collections either because of land reclamation efforts or natural colonization of the bare sites over time. In 1971, soil was collected from 0 to 2.5 cm and from 5 to 10 cm. In subsequent years, the sampling was carried out at depth intervals of 0 to 5, 5 to 10, and 10 to 15 cm, which are now standard Phytotoxicology soil sampling protocols. Single samples were collected at each site in 1971. Sampling was conducted in triplicate in 1976 and 1981 and in duplicate in 1992 and 1997. Analysis of the samples included nickel, copper, cobalt, arsenic, iron, sulphur, selenium, and zinc in all years. Additional elements were available for analysis in later years due to improved analytical techniques.

Unlike the data from the *Sudbury Regular Survey*, the results from the *Sudbury Special Survey* have not been formally published in an MOE report. The *Sudbury Special* data was supplementary to the *Sudbury Regular* data, and although it added to the understanding of metal loadings in the Sudbury area it did not represent new or significant revelations. In addition, the *Sudbury Special* data was circulated among government, academic, and industrial organizations, was used in local environmental workshops and symposiums, and was an important data base for the Sudbury Land Reclamation Program.

C. Year 2000 Surface Soil Survey

In early 2000, data from the *Sudbury Regular* and *Sudbury Special* surveys were assessed to identify any geographic data gaps. Only the more recent data from sites that were accurately located were used for this preliminary exercise. While this assessment corroborated the pattern anticipated from general monitoring experience in the area and provided reasonable preliminary estimates of the contaminant distribution in soil, it also illustrated that some areas had relatively poor coverage and

therefore areas where additional samples were needed.

In the summer of 2000, surface soil samples (0-5 cm) were collected at 103 additional sites in the Sudbury area (Appendix C - Maps 1 and 2). The sampling followed standard Phytotoxicology protocols [15] and the samples were analyzed for a suite of chemical elements that included nickel (Ni), copper (Cu), cobalt (Co), arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), molybdenum (Mo), selenium (Se), vanadium (V), zinc (Zn), calcium (Ca), magnesium (Mg), iron (Fe), aluminum (Al), manganese (Mn), sulphur (S), strontium (Sr), beryllium (Be), and barium (Ba).

Due to the presence of an extensive naturally occurring nickel and copper ore bodies in the Sudbury area, some questions have been raised about the applicability of the Table F guideline for nickel (43 µg/g) and copper (85 µg/g) in the Sudbury area. One approach to addressing this question has been to utilize the nickel results from previous sampling stations for which there is soil profile data, 0-5, 5-10, 10-15 cm depths, to determine the background concentrations for the area. Assuming the contamination is from areal deposition, the concentrations will be highest in the surface soil and will decrease with depth. Therefore, the depth soil results should more closely represent natural background nickel and copper concentration.

III. ANALYTICAL RESULTS

A. Sudbury Regular Survey 1999

The analytical results for the 1999 *Sudbury Regular Survey* are summarized in Tables 1 to 3. The results for soil (Table 1), birch foliage (Table 2), and grass forage (Table 3) samples are briefly discussed below.

i) Results of Soil Analysis

In 1999, only 8 of 20 elements, those being arsenic, cadmium, cobalt, chromium, copper, nickel, selenium, and strontium, exceeded the MOE Table F background-based soil guidelines (Table 1). Of these eight elements, only nickel, copper, cobalt, and arsenic exceeded the MOE Table A effects-based soil guidelines at the sites closest to Copper Cliff and Falconbridge, specifically Garson, Skead, Ramsey Lake, and Tilton Lake. In general, the higher metal concentrations were found in samples from the top of the soil profile, which is consistent with aerial deposition. The highest nickel (1,000 µg/g) and copper (980 µg/g) concentrations were found at Ramsey Lake, while the highest cobalt (57 µg/g) and arsenic (32 µg/g) concentrations were found at Tilton Lake and Skead, respectively. For the most part, the pattern of soil metal contamination below 5 cm followed the surface concentration pattern; however, the nickel concentration at Callum in 1999 was slightly elevated throughout the depth profile. Soils at this location are particularly sandy (near a sand and gravel pit). The lack of organic matter and clay particles, combined with the relatively large pore size of sand, provide very little chemical or mechanical binding power so that contaminants move more readily through sandy soil.

Calcium concentrations in Sudbury area soils were low but within the normal concentration range

for northern Ontario soils. The lowest mean soil calcium concentrations occurred in soils from Skead and Chiniguichi Lake area. The significance of these sites includes the fact that Skead was historically one of the sites most heavily impacted by SO_2 and calcium would have been more readily leached from the soil by inputs of sulphuric acid. Chiniguichi is a considerable distance from Sudbury but it is located directly downwind of the smelters, the soils are known to be poorly buffered, and lakes in that area have become acidic.

Despite high SO_2 emissions over the past six decades, little evidence of sulphur accumulation in soil was observed in 1999. Sulphur is more reactive in the soil than most of the heavy metals and a lower concentration of sulphur in the soil may be due to the implementation of SO_2 abatement programs. However, the unit of measurement for sulphur in soil is percent and not parts per million, so the ability to measure relatively minor changes is compromised. The only site in 1999 with a soil sulphur concentration above the OTR_{98} was Ramsey Lake, which is likely due to the frequent SO_2 fumigations that were measured historically in the Sudbury Basin.

The concentrations of the remaining elements (aluminum, barium, beryllium, calcium, iron, lead, magnesium, manganese, molybdenum, strontium, vanadium, and zinc) did not exceed background levels. This was anticipated because the smelters at Sudbury are not known to emit these elements in substantial quantities.

ii) Results of Vegetation Analysis

In 1999, only 7 of 20 elements, those being cadmium, chlorine, iron, magnesium, nickel, selenium, and zinc, exceeded the Upper Limit of Normal (ULN) guidelines for unwashed rural tree foliage (Table 2). In 1999, only 3 of 20 elements, those being chlorine, iron, and nickel, exceeded the ULN guidelines for unwashed grass forage (Table 3).

Only one site in 1999 had elevated iron (520 µg/g) in both tree foliage and grass forage (Tables 2 and 3). These concentrations occurred at Temagami, which is an area known for its iron deposits.

Four sites had nickel concentrations above the ULN guideline of 30 µg/g in paper birch foliage (Table 2). These included Garson, Rayside, Skead, and Tilton Lake. The highest concentration was 50 µg/g nickel at Garson. Only one forage collection site, Tilton Lake (27 µg/g) had a nickel concentration above the ULN guideline of 25 µg/g in grass forage (Table 3).

The zinc concentrations measured in paper birch foliage in 1999 exceeded the ULN guidelines at 18 of the 21 sites sampled (Table 2). Birch species are known to accumulate zinc to higher levels than most other species growing in the same soils. No obvious distribution pattern relative to the Sudbury area smelters was noted, and the smelters are not known to emit zinc in substantial amounts. The zinc concentrations in birch foliage measured at over half of the sites were higher in 1999 than in any of the previous years. There is not a readily apparent explanation for this, but the trend did not extend to the grass forage samples (Table 3).

Despite the general publicity and magnitude of sulphur dioxide emissions from the Sudbury area

smelters, the number of sites where excessive levels of sulphur occur in vegetation is fairly limited, based on the present survey. However, like soil, the concentrations of sulphur are measured in percent (as opposed to µg/g for other elements) and substantial quantities of the element must be absorbed by the foliage before significant changes in the foliage chemistry become apparent. Also, the process of development of sulphur dioxide-induced injury to plant foliage does not necessarily require the uptake of large amounts of SO_2 into the tissues. None of the sites sampled in 1999 had sulphur concentrations above the ULN guideline.

For the remaining elements, the measured concentrations indicate background levels.This would be anticipated because the Sudbury smelters are not known to emit these elements in substantial quantities. The elements which had strictly background concentrations in tree foliage include aluminum, arsenic, barium, boron, beryllium, calcium, cobalt, chromium, iron, potassium, lead, manganese, molybdenum, strontium, sulphur, and vanadium. In addition to these elements, cadmium, magnesium, selenium, and zinc also had background concentrations in grass forage.

B. Sudbury Special Survey 1971 - 1997

Because of the large amount of data obtained from the *Sudbury Special Survey* (Tables 4 to 27), it is not practical to discuss the analytical data in detail. The following summaries are provided mainly as general observations and patterns. See Maps 1 and 2 for soil and vegetation sampling locations (Appendix C).

i) Results of Soil Analysis

The concentrations of elements measured in the soil samples are summarized in Tables 4 to 16.

Arsenic

The highest arsenic concentration measured was 510 µg/g at Site 23 (1 mile north of Falconbridge) in 1976 (Table 4), although by 1992 the soil arsenic level at the same sample site had fallen to 57µg/g. Other sites with arsenic concentrations greater than 200 µg/g included Sites 22 (290 µg/g), 24 (350 µg/g), 29 (470 µg/g), and 30 (350 µg/g), all of which are located within 3 km of the Falconbridge smelter. By comparison, the maximum arsenic concentration near Copper Cliff was 290 µg/g found at Site 97 in 1971 (1 mile west of the smelter). The pattern of background-based Table F guideline exceedences (17 µg/g) follows closely the pattern of effects-based Table A guideline exceedences due to the small difference between the two guidelines. About half of the sites exceeded the background-based Table F guideline of 17 µg/g in 1971.

Surface soils had higher concentrations of arsenic than did the samples from the lower soil profiles.

Cobalt

The maximum cobalt concentration of 788 µg/g was found at Site 99 in 1971 (3 miles west of Copper Cliff) with concentrations decreasing with depth (Table 5). Nearly one third of the sites sampled exceeded the cobalt Table F guideline of 21 µg/g. Fewer sites exceeded the cobalt Table A guideline of 40 µg/g (Table 5). The highest concentrations of cobalt occurred near Copper Cliff,

although soil cobalt levels were proportionately elevated within three miles of Falconbridge.

Copper

Only eleven of 92 sites did not exceed the Table F (85 µg/g) guideline at some point between 1971 and 1997 (Table 6). The Table A guideline was exceeded at approximately half of the sites sampled in 1997. In 1997, the highest copper concentration measured was 2,800 µg/g (Site 96, 0.5 miles west of Copper Cliff). The other sites where copper exceeded 1,000 µg/g were Site 72 (0.5 miles east of Copper Cliff, 1,600 µg/g, 1997), Site 97 (1 mile west of Copper Cliff; 1,900 µg/g, 10-15 cm, 1997), and Site 106 (0.5 miles south of Copper Cliff; 1,300 µg/g, 0-5 cm, 1992).

The highest copper concentrations were encountered in the surface horizon and decreased with depth. Sites within about 5 km of Copper Cliff had copper concentrations considerably greater than sample sites elsewhere in the Sudbury area.

Iron

Five sites of 92 sampled had soil with iron concentrations above the OTR_{98} guideline in one or more years (Table 7). Two of these 5 sites had single year/depth exceedences, while the remaining three sites had multiple depth exceedences. At Site 97, located 1 mile west of Copper Cliff, the surface soil iron level exceeded the background guideline in 1971, 1986, 1992, and 1997. The high concentrations were particularly evident throughout the soil profile in the two most recent collections.

Nickel

A large proportion of the soil samples collected for the *Sudbury Special Study* contained nickel in concentrations above both the Table F and Table A guidelines (Table 8). In 1997, every surface soil site except two (Sites 35 and 70) exceeded the Table F guideline of 43 µg/g. The majority of these sites also exceeded the Table A guideline of 150 µg/g. In earlier years, the frequency of exceedences were lower. The highest nickel concentrations were found in the surface soil and decreased with depth.

The highest nickel concentrations were measured in 1997 with a maximum concentration of 2,300 µg/g occurring at Station 72 (0.5 miles east of Copper Cliff). The most conspicuous soil nickel contamination was observed in close proximity to the Copper Cliff smelter.

Selenium

Selenium concentrations in soil exceeded the Table A guideline of 10 µg/g at two sites (Table 9); these were Sites 96 and 97 (0.5 and 1 mile west of Copper Cliff, respectively) between 1986 and 1997. Surface soil (0-5 cm) at this site had selenium concentrations ranging from 11 to 33 µg/g, with the highest concentration being found in 1986. Sub-surface concentrations exceeded the Table A guideline in 1986 and 1997 but in the other years, the concentrations were much lower indicating considerable heterogeneity of the soil. The highest concentration at Site 97 was found at the 10-15 cm level in 1997.

A pattern in selenium concentrations is noted when the data above background but below the Table A guideline from sites surrounding Copper Cliff are reviewed. There are three sets of contiguous

sites leading from Copper Cliff to Lively (Sites 96 to 100), Belanger (Sites 87 to 91) and Sudbury (Sites 72, 74 and 75) respectively that roughly follow the transportation system. This suggests that the use of waste materials or spent ore from tailings may have been used in the construction or maintenance of these roads and rights of way and are a contribution to the overall distribution of this metal, and possibly others, within the local environment.

Sulphur

In 1971, approximately half of the surface soils exceeded the OTR_{98} guideline (Table 10). Neither Table A nor Table F guidelines have been developed for sulphur. The maximum concentration of 1.7 % sulphur was measured at Site 97 (1 mile west of Copper Cliff) in 1986. That site had elevated sulphur concentration throughout the soil profile fairly consistently over the study period.

Zinc

The zinc concentrations measured in the soil exceeded the Table F guideline of 160 µg/g at five sites (Table 11). These included Sites 46, 59, 63, 66, and 87. There is no consistent pattern of elevated zinc in soil in relation to the three smelters.

Aluminum

The aluminum concentrations measured in the soil exceeded the OTR_{98} guideline of 30,000 µg/g aluminum (neither Table A nor Table F guidelines have been developed for aluminum) at two locations (Table 12). These included Sites 62 and 89. There is no consistent pattern of elevated aluminum in soil in relation to the three smelters.

Cadmium

The cadmium concentrations measured in soil exceeded the Table F guideline of 1.0 µg/g at 22 of 92 sites (Table 12). No sample sites exceeded the Table A effects-based guidelines.

Calcium

No sample sites exceeded the OTR_{98} guideline of 55,000 µg/g calcium (Table 13). Neither Table A nor Table F guidelines have been developed for calcium because this element is a major plant nutrient.

Lead

The lead concentrations measured in soil exceeded the Table F guideline of 120 µg/g at 5 of 92 sites sampled (Table 14). These included Sites 22, 87, 95, 101, and 113. Four of these sites exceeded the Table A effects based guideline of 200 µg/g, with the highest concentration (1,000 µg/g) occurring at Site 87 (5-10 cm, 1986). Four of the five sites are within the vicinity of the Copper Cliff smelter.

Magnesium

The magnesium concentrations measured in the soil exceeded the OTR_{98} guideline of 20,000 µg/g at one site, Site 37 (neither Table A nor Table F guidelines have been developed for magnesium)(Table 15). Although this site is located within 1 mile of the Falconbridge smelter, the value only slightly exceeded the OTR_{98} guideline and no consistent concentration gradient was evident relative to the three smelters.

Other Elements

In 1997, soil samples were also analyzed for barium, beryllium, manganese, molybdenum, strontium, and vanadium (Table 16). Exceedences occurred at only five sites. Site 44 had a molybdenum concentration (4.2 µg/g) above the Table F guideline of 2.5 µg/g, Site 63 had chromium concentrations (72 to 74 µg/g) above the Table F guideline of 71 µg/g, Site 97 had both barium and chromium above Table F guidelines of 210 µg/g and 71 µg/g, respectively, and Sites 102 and 103 had chromium concentrations above the Table F guideline. All other metals were not elevated above background, which was anticipated because the smelters at Sudbury are not known to emit these elements in substantive quantities.

ii) Results of Vegetation Analysis

The concentrations of chemicals measured in the vegetation samples are summarized in Tables 17 to 27.

Arsenic

Elevated levels of arsenic in vegetation were found to be much more prevalent in trembling aspen foliage than in grass forage (Table 17). In part, the differences between species may be related to the respective guidelines (2 µg/g arsenic for tree foliage and 8 µg/g arsenic for forage). The highest arsenic concentrations (12 µg/g in aspen, 20 µg/g in forage) occurred at Site 31, located 2 miles northeast of the Falconbridge smelter in 1976, and Site 29, located 0.5 miles northeast of Falconbridge in 1976, respectively.

Cobalt

The concentrations of cobalt in vegetation were conspicuously greater in trembling aspen foliage than in grass forage samples (Table 18). It must be noted that there are different guidelines for tree foliage and for grass forage. The maximum concentration of cobalt in aspen foliage was 17 µg/g (Site 82, about 10 miles east of Copper Cliff) in 1971 and in grass forage was 12.7 µg/g (Site 29, 0.5 miles northeast of Falconbridge) in 1976.

Copper

The concentrations of copper in vegetation were greater in trembling aspen foliage than in grass forage samples (Table 19). The highest copper concentrations found in aspen was 360 µg/g in aspen (Site 95, 20 miles north of Copper Cliff) and 220 µg/g in forage (Site 96, 0.5 miles west of Copper Cliff). Both high concentrations occurred in 1976. The two high values were notably higher than most of the other concentrations, even at these same locations in other years.

Iron

The concentrations of iron in the vegetation samples ranged widely (Table 20). The iron concentrations were most frequently elevated in the 1971 and 1976 collections. The highest concentrations measured were 5,500 µg/g in aspen and 3,200 µg/g in forage in 1981; both at Site 114, 25 miles south of Copper Cliff.

Nickel
Nickel concentrations in vegetation frequently exceeded the ULN guideline (Table 21). The highest nickel concentrations were 340 µg/g and 240 µg/g, respectively, in aspen and forage. Both high levels occurred in 1976. The aspen sample was collected 2 miles east of Coniston (Site 64) while the forage was collected 1 mile south of Copper Cliff (Site 107).

Selenium
Samples were not analyzed for selenium in 1971 (Table 22). The highest selenium concentration was found in aspen (5.3 µg/g) at Site 71 (about 25 miles east of Coniston) and in forage (4.1 µg/g) at Site 107 (1 mile south of Copper Cliff). Both of these occurred in 1976.

Sulphur
As might be anticipated following the commissioning of the superstack in 1972, the concentrations of sulphur in both aspen foliage and forage declined steadily with time until there were no exceedences in 1997 (Table 23). Forage concentrations exceeded the sulphur guideline of 0.5% at only 6 locations, all in 1971.

Zinc
Zinc is known to accumulate naturally in the foliage of some species, notably poplars, willow, and birch. No guideline specific to these species has been developed, however, the zinc concentrations observed in tree foliage in the Sudbury area were consistent with typical background levels encountered elsewhere in the province. Four samples of grass forage had zinc levels in excess of the 100 µg/g ULN guideline for forage (Table 24). These few exceedences did not appear to be related to the smelters.

Aluminum, Cadmium, Calcium, Lead, and Magnesium
Vegetation data for aluminum, cadmium, and calcium are summarized in Table 25 while lead and magnesium data are summarized in Table 26. For the duration of the *Sudbury Special Survey*, no vegetation samples had aluminum, cadmium, lead, or magnesium concentrations above the ULN guidelines for unwashed tree foliage and grass forage. These results are expected, since the smelters at Sudbury are not known to emit these elements in substantial quantities.

Other Elements
In 1997, vegetation samples were also analyzed for barium, beryllium, boron, chlorine, chromium, potassium, manganese, molybdenum, strontium, and vanadium (Table 27). Of these elements, only foliar chlorine concentrations exceeded the ULN guideline of 0.15%. These results are anticipated because the smelters at Sudbury are not known to emit these elements in substantial quantities.

C. Year 2000 Surface Soil Survey

i) Results of Soil Analysis

The analytical results for the soil samples collected in 2000 are summarized in Table 28. Soil levels for the following 10 metals in all 103 samples never exceeded their respective background levels and are discussed no further in this survey: aluminum, barium, beryllium, calcium, chromium, magnesium, manganese, vanadium, zinc and strontium.

Six other metals including iron, molybdenum, lead, cadmium, cobalt and selenium occasionally and sporadically exceed either their respective Table F (background) or OTR_{98} values. Iron exceeds the OTR_{98} at Site 370 and 393 with 36,000 and 45,000 µg/g respectively . Molybdenum exceeds the Table F background value at Site 393 with 3.6 µg/g. Lead exceeds the Table F background value at only two sites, Site 358 with 140 µg/g and Site 389 with 160 µg/g. Cadmium marginally exceeds its background value at five sites (337, 341, 351, 353,and 382). The data set for selenium is incomplete due to an error in ordering tests from the analytical laboratory. Available selenium data indicates that it exceeds background only at 8 of 103 sites. Cobalt exceeds its background level at 8 of 103 sites in this study with the highest value of 36 µg/g observed at Site 411, west of Coniston.

Soil nickel, copper and arsenic concentrations exceeded their Table F guidelines at most sites, and exceeded their respective Table A guidelines to varying degrees and frequencies. Each of these is discussed in more detail below. It is important to note that in all cases the effects-based Table A guideline for these three metals and arsenic is for the protection of sensitive plants.

Nickel

Nickel is the most widely dispersed metal in soil with respect to elevations above the provincial background (43 µg/g). The 43 µg/g guideline is exceeded from about Espanola on the west to nearly Hagar on the east, a distance of about 110 km in the east-west direction. The area above background extends a similar distance north to south. The distribution pattern is quite complex, with several areas extending from the three main smelting centres of Copper Cliff, Falconbridge, and Coniston.

Ninety four of the 103 sampling sites have nickel levels that exceed both the background (43 µg/g) and effects based (150 µg/g) guideline for nickel. Of these, 45 sites exceed the effects based number. Most of the data shows a localized and higer concentration of nickel at sites clustered around the three sources.

Sites 358, 359 and 360 (520, 250 and 260 µg/g) respectively are all located to the north and west of Falconbridge. These same sites are identified as elevated with other metals as well as nickel in the historic data.

Sites 362 through 374 are clustered around the vicinity of Copper Cliff and values that exceed the effects based guideline here range from a high of 690 µg/g to a low of 170 µg/g with the higher

values closer to Copper Cliff.

Sites 408 through 437 (excluding Sites 410 and 411) are roughly clustered around Coniston. Values that exceed the effects based guideline here range from a high of 480 µg/g to a low of 180 µg/g. Again, there is trend towards a gradual decrease in levels with increased distance from Coniston.

Sites 337, 338, 339 and 341 (520, 25, 330 and 210 µg/g respectively) along with Sites 410 and 411 (270 and 980 µg/g respectively) present a different picture, with most concentrations marginally above background and two well above effect based guideline. These sampling sites tend to follow the highway corridor running into and out of the City of Sudbury, in one case north/ south in the other case east/ west. This may suggest the use of tailings material or waste ore in road construction. This same phenomenon was also observed for selenium in the Sudbury Special 1971-1997 survey data around Copper Cliff.

A single location greater than 43 µg/g nickel is identified to the east of Sudbury at Site 18 near Sturgeon Falls. However, this is driven by a single sample point. It is unlikely that this marginally elevated nickel concentration reflects generally elevated soil nickel levels in the Sturgeon Falls area. Because some sample sites between Sturgeon Falls and Sudbury have lower soil nickel levels, it is unlikely that the marginally elevated level at Site 18 is related to the Sudbury mining industries.

Copper

Copper levels exceed background at a total of 71 sites (70% of all sites) including 26 sites (25% of all sites) that also exceed the Table A effects based guideline. Except for two isolated samples that produced elevated copper results (one to the west and the other to the south), the area of elevated soil copper concentrations above the Table F background-based guideline of 85 µg/g is fairly well defined. This area extends from Whitefish on the west to approximately Lake Ashigami on the east, a distance of about 60 km. The north-south distance is similar, extending north of Capreol to Lake Nepewasi in the northeast and the east end of Lake Penage in the southwest.

Concentrations of elevated copper in soil occurred most consistently in the vicinity of Copper Cliff (Sites 360, 362, 363, 364 with levels of 330, 450, 390 and 280 µg/g respectively). There also appear to be two small areas above 500 µg/g copper near each of the Coniston (Sites 405, and 414 at 600 and 670 µg/g respectively) and Falconbridge (Sites 358 and 359 with 740 and 260 µg/g respectively) smelters. The Falconbridge Site 358 had the one of the highest observed copper concentration in this study.

Arsenic

Arsenic is observed to exceed its background and effects based guideline at a total of 19 of 103 sites, including 15 sites that exceed the effects-based guideline

The highest arsenic levels are observed in the vicinity of Falconbridge at Sites 358 and 359 with

levels of 130 and 70 µg/g respectively. Sites 413 and 414 with levels of 25 and 37 µg/g respectively are situated to the west and south of Falconbridge suggesting an overall increase in soil arsenic burden in the general area caused by the smelter. The fact that these sites are also identified as having elevated levels of nickel and copper is considered additional evidence of a localized effect from the smelter.

Sites 360 and 362 at 25 and 22 µg/g respectively are also marginally above the Table A guideline. There is the potential that these sites in combination with sites and observations reported in the earlier studies (*Sudbury Special and Sudbury Regular*) and influenced by the Coniston and Copper Cliff smelters respectively.

Sites 370, 371, 376 and 393 with levels of 73, 21, 37 and 28 µg/g respectively are the next highest levels found. However there does not seem to be any pattern in these sites or the concentrations other than their locations south and west of Copper Cliff, suggesting an overall increase in soil burden in the general area caused by the smelter.

ii) Background Nickel Concentrations In Sudbury Area Soil

The most recent depth soil data from the *Sudbury Regular Survey*, and the *Sudbury Special Survey* were pooled to create a data base of 108 sample sites utilized in estimating the background nickel concentration in soil for the Sudbury area (see table below). A summary of the number of stations that fall within four ranges of nickel below 43 µg/g at the three sample depths is given in the following table. It is clear that even at 5 to 10 cm there are significantly more stations below the 43 µg/g Table F background value for nickel in soil than at 0 to 5 cm. The number of stations below 43 µg/g at the three depths, and a consistent pattern of lower soil nickel levels at depth, suggests that the Table F value of 43 µg/g nickel is a reasonable estimate of background for the Sudbury area.

Number of the Sampling Stations that Fall Within the Four Ranges of Nickel Concentration at the Three Sample Depths.

	Soil Depth		
Nickel Range	0 to 5 cm	5 to 10 cm	10 to 15 cm
<20 µg/g	2	9	7
20 to 29.9 µg/g	6	17	23
30 to 39.9 µg/g	5	12	14
40 to 42.9 µg/g	0	2	3
Total <43 µg/g	13	40	47

SUMMARY AND DISCUSSION

The MOE has been monitoring the terrestrial environment in the Sudbury area since 1970. Extensive sampling of soil, aspen and paper birch foliage, and grass forage has illustrated that elevated levels of heavy metals (specifically nickel, copper, and cobalt) and arsenic are common in the Sudbury area, and are particularly elevated in the vicinity of the three historic smelting and refining centers of Copper Cliff, Coniston, and Falconbridge. The highest concentrations in soil consistently occur in the upper horizons, indicating that the source of the contamination is atmospheric deposition. Even though many sites have been sampled several times over the last 30 years, it is not possible to confidently identify contaminant time trends due to changes in laboratory procedures, the uncertainty that precisely the same site was sampled, and the natural variability of these contaminants in the terrestrial environment. The exception is sulphur in vegetation, which has declined subsequent to the construction of the Inco superstack and with reductions in SO_2 emissions legislated by the MOE Countdown Acid Rain Program, which was completed in 1985. Elevated metal levels in vegetation are expected to continue as long as the contaminants are present in the soil and potentially available to be taken up by plants through their root systems.

The soil contaminant data illustrate that the highest soil metal levels are likely to occur in the urban communities close to the three industrial centers of Copper Cliff, Falconbridge, and Coniston. Because the emphasis in the past has been on defining the extent of the atmospheric deposition (i.e., the "footprint", how far it goes) the majority of the samples were collected at distance, and the urban areas of the City of Greater Sudbury were under-sampled. Additional sampling is required in the Sudbury urban area to further characterize soil contaminant levels.

The MOE Table A effects-based soil guidelines for nickel, copper, cobalt, and arsenic are generic values intended to be used anywhere in the province. The generic soil guidelines are based on the principal of protecting the most sensitive receptor. In setting these guidelines the Ministry reviewed the scientific literature for each contaminant and determined the lowest observable effect level (LOEL) for the most sensitive plants, animals, and aquatic organisms and the no observable effect level (NOEL) for human health. The lowest value was then selected as the generic guideline. For nickel, copper, cobalt, and arsenic the most sensitive receptors are plants: specifically, plants are injured at soil concentrations lower than those observed to affect animals, aquatic organisms, or people. Furthermore, not all plants would be injured at soil levels above the generic guideline, because there is a very broad range in plant sensitivity to soil contaminant concentrations. Therefore, the MOE Table A effects-based generic guidelines for nickel, copper, cobalt, and arsenic are based on the ***potential*** for injury to sensitive plant species. Soil concentrations above the Table A guidelines do not imply that plant injury ***will*** occur, but rather that it ***may*** occur if the most sensitive plant species are present and the soil characteristics are such that the contaminant is bioavailable (can be taken up from the soil by plant roots).

Soil contaminant concentrations close to the Sudbury smelters have been shown to be phytotoxic, and steps to counter the metal toxicity in the soil were required to establish vegetation in some areas remediated by the Sudbury Land Reclamation Program. Recently, substantial new plant growth, particularly paper birch, has occurred in some previously severely impacted areas at sites that did not receive soil amendments as part of the Sudbury Land Reclamation Program. Paper birch is very

sensitive to SO_2 and the re-establishment of paper birch in these areas is a result of the reduction in the frequency of injurious ground level SO_2 fumigations. However, even in the absence of SO_2 fumigations the birch seedlings could not have become established on these sites if the soil metal levels were directly phytotoxic. Therefore, even though large areas of Sudbury exceed the Ministry Table A effects-based generic soil guidelines it is clear that air quality and not soil metal levels was the main factor limiting the natural re-establishment of vegetation. For the Sudbury area, soil metal levels substantially above the Table A guidelines are required before phytotoxicity occurs in local species of vegetation.

Recent health studies conducted in Wawa [24], Deloro [27], and Balmertown [26] found no measurable health impacts associated with soil arsenic levels in urban residential areas in the range of 500 to 2,000 µg/g. The highest soil arsenic level found in Sudbury to date is 510 µg/g in 1976. However, sampling of the same site in subsequent years could not reproduce that high value. The most recent soil arsenic level for that site is 57 µg/g, obtained in 1992. The maximum soil arsenic level obtained during the most recent and most extensive sampling in Sudbury, conducted between 1997 and 2000, was 130 µg/g, and relatively few sites exceeded the 20 µg/g MOE guideline. Although these other community studies contribute significantly to the understanding of how environmental contaminants may affect human health, they are site specific, meaning they are conducted using environmental conditions and multimedia assessments specific to their host community and their conclusions are valid only for that specific community.

In reviewing the extensive soil data base developed for the Sudbury area the ministry concludes that additional sampling and action is warranted. Especially in Sudbury's residential and publically-accessible urban green space, and communities adjacent to the three smelting centers of Copper Cliff, Coniston, and Falconbridge. Therefore the Ministry has developed a work plan to fill these important knowledge gaps.

- Over the summer and fall of 2001 the two industries will be collecting surface soil in remote areas around the Sudbury basin in an attempt to 1) confirm the local background concentrations for the contaminants of concern, if different from the Ministry's Table F guideline, and 2) having defined true local background, accurately determine the spacial extent of the heavy metal and arsenic deposition associated with their mining and smelting activities.

- Over the same time period, the companies will also be characterizing the soil contaminant status of their land holdings in areas where they exist adjacent to residential communities.

- During the summer 2001 the Ministry will collect surface soil samples from all schools and commercial day care centers in Sudbury.

- In the late summer and fall of 2001 the Ministry will sample soil and vegetable garden produce from a representative number of residential properties in the communities of Copper Cliff, Coniston, and Falconbridge.

- Throughout the summer and fall of 2001, the Ministry will sample blueberries, other wild

berries, and berries from commercial farms in areas of suspected elevated soil levels.

- In the fall of 2001 the Ministry will sample surface soil from representative residential properties and major public parks in Sudbury.

The data obtained from the Ministry and industry 2001 sampling programs will be developed, prepared and distributed as public reports. It is possible that the data from the 2001 studies may identify the need for additional soil sampling in 2002. Nonetheless, the soil information obtained from the 2001 sampling program, in conjunction with the data from this report and the extensive existing Sudbury environmental data base, form the essential building blocks upon which an ecological and human health risk assessment for impacted communities in the City of Greater Sudbury, will be developed.

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Table 1: Metals Concentration in Soil Profiles Collected at 21 Stations in the Sudbury Area, 1999 Regular Survey Results

Station	Soil Depth	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	Se	Sr	S	V	Zn
1 Blind River	0-5 CM	8800	1.4	50	<0.5	2400	0.25	5.1	19	5.5	10000	2200	220	<0.5	11	13	0.25	17	0.02	25	35
	5-10 CM	9300	1.3	49	<0.5	2300	<0.2	5.2	19	5.5	10000	2200	190	<0.5	10	12	0.25	18	0.01	26	33
	10-15 CM	9700	1.3	48	<0.5	2300	<0.2	5.3	21	5.5	11000	2400	170	<0.5	11	9	<0.2	18	0.01	27	33
2 Burwash	0-5 CM	8600	11	24	<0.5	2300	<0.2	6.1	23	85	14000	2000	140	<0.5	**88**	41	0.95	16	0.03	32	25
	5-10 CM	9400	3.5	41	<0.5	2000	<0.2	5.3	24	22	14000	2000	200	<0.5	26	8	0.3	16	0.02	34	23
	10-15 CM	9100	1.7	51	<0.5	2100	0.25	4.4	22	5.5	13000	1900	210	<0.5	32	4.5	<0.2	17	0.01	33	22
3 Callum	0-5 CM	14000	7.2	49	<0.5	2700	0.25	12	38	37	20000	4500	380	<0.5	**48**	11	0.45	22	0.02	41	50
	5-10 CM	15000	9	65	<0.5	2500	0.25	12	40	45	21000	4500	440	<0.5	**61**	12	0.45	21	0.02	41	55
	10-15 CM	16000	9.1	72	<0.5	2400	0.25	13	40	44	22000	4300	680	<0.5	**63**	12	0.45	22	0.03	41	63
4 Chiniguchi	0-5 CM	3800	6.1	40	<0.5	650	<0.2	1.8	11	24	5300	1000	49	<0.5	24	13	0.45	8	0.01	15	7
	5-10 CM	4600	4.7	52	<0.5	650	<0.2	1.9	13	11	6000	1300	48	<0.5	11	5.5	0.25	8	0.01	17	6
	10-15 CM	5900	2.6	60	<0.5	800	<0.2	3.1	18	9	7900	2000	67	<0.5	13	3	<0.2	11	0.01	19	9
5 Fairbanks	0-5 CM	11000	9.6	50	<0.5	1300	0.4	3.2	23	62	19000	1100	190	0.65	**64**	38	1.7	14	0.04	45	37
	5-10 CM	21000	5.9	32	<0.5	1700	0.4	3.5	34	17	24000	2300	190	0.85	16	14	1.5	16	0.03	51	44
	10-15 CM	22000	4.7	30	<0.5	2100	0.65	4.1	34	17	22000	2800	180	0.85	15	11	1.4	20	0.03	48	45
6 Garson	0-5 CM	8300	14	39	<0.5	2400	0.85	12	21	**200**	12000	1700	190	<0.5	**230**	26	1.7	17	0.03	27	39
	5-10 CM	8900	8.9	42	<0.5	2100	0.35	6.8	21	**91**	11000	1700	120	<0.5	**130**	23	0.85	17	0.03	28	35
	10-15 CM	8300	7.6	44	<0.5	2000	0.35	6.5	20	83	11000	1600	100	<0.5	**110**	16	0.8	17	0.02	27	36
7 Grassey Lake	0-5 CM	8900	2.5	71	<0.5	4100	<0.2	6	29	17	14000	3700	250	<0.5	27	16	0.25	22	0.04	28	46
	5-10 CM	8800	2.8	76	<0.5	3700	<0.2	5.9	28	16	14000	3600	250	<0.5	26	17	0.25	20	0.03	28	45
	10-15 CM	10000	2.4	76	<0.5	3800	0.25	6.4	33	14	14000	4000	240	<0.5	28	12	<0.2	21	0.03	29	43
8 Killarney	0-5 CM	6500	3.6	33	<0.5	1800	<0.2	4.5	19	19	11000	1800	160	<0.5	21	21	0.6	15	0.05	29	27
	5-10 CM	6700	3.1	34	<0.5	1600	0.25	4.4	18	15	10000	1700	140	<0.5	16	17	0.45	14	0.04	27	21
	10-15 CM	6200	1.8	31	<0.5	1700	0.25	3	16	12	7800	1700	93	<0.5	12	13	0.3	14	0.03	22	15
9 Kukagami Lake	0-5 CM	7700	6.1	62	<0.5	2000	0.35	7.4	19	39	11000	1800	420	<0.5	**51**	18	0.65	17	0.02	25	41
	5-10 CM	8000	4.6	55	<0.5	1400	<0.2	4.8	18	25	10000	1300	250	<0.5	27	9.5	0.45	15	0.01	24	29
	10-15 CM	10000	2.3	57	<0.5	1500	<0.2	5.1	22	12	13000	1500	190	<0.5	19	6	0.3	15	0.01	29	35
10 Mattawa	0-5 CM	6900	1.1	25	<0.5	1900	<0.2	2.8	15	5	10000	1600	120	<0.5	6.9	13	<0.2	7.5	0.01	22	31
	5-10 CM	8200	0.85	17	<0.5	1200	<0.2	2.3	13	2.5	11000	1000	96	<0.5	4.4	8	0.3	5.5	0.01	22	26
	10-15 CM	12000	0.55	18	<0.5	1700	0.25	3.4	18	2.5	14000	1300	130	<0.5	5.9	5	<0.2	6.5	0.01	27	32
11 Milnet	0-5 CM	9500	8.5	56	<0.5	2000	0.45	4.9	24	40	15000	1700	290	<0.5	**45**	31	0.9	17	0.04	32	57
	5-10 CM	11000	4.4	40	<0.5	1400	0.3	3.4	22	20	13000	1400	160	<0.5	24	19	0.65	14	0.03	30	41
	10-15 CM	15000	2.3	35	<0.5	1600	0.25	4.4	26	11	14000	1800	150	<0.5	22	10	0.5	14	0.02	32	44

Table 1: Metals Concentration in Soil Profiles Collected at 21 Stations in the Sudbury Area, 1999 Regular Survey Results

Station	Soil Depth	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Ni	Pb	Se	Sr	S	V	Zn
12 Morgan	0-5 CM	5200	3.8	29	<0.5	3100	0.25	5.5	22	28	9700	2700	220	<0.5	**44**	16	0.4	19	0.01	25	29
	5-10 CM	5300	3.4	33	<0.5	3000	0.3	5	23	23	9600	2600	240	<0.5	37	12	0.35	19	0.01	26	26
	10-15 CM	4900	2	29	<0.5	2800	0.25	4	21	11	8900	2400	200	<0.5	22	5.5	0.25	19	0.01	24	22
13 Nairn	0-5 CM	11000	3.1	61	<0.5	4100	0.25	14	25	52	19000	3800	310	0.55	**56**	50	0.5	24	0.04	44	73
	5-10 CM	11000	2.9	41	<0.5	3700	0.25	15	26	57	21000	3900	260	<0.5	**52**	34	0.35	23	0.03	45	60
	10-15 CM	9900	2.1	43	<0.5	3500	<0.2	11	23	43	17000	3400	310	<0.5	39	27	0.25	24	0.02	42	51
14 Lake Penage	0-5 CM	16000	9.8	53	<0.5	1800	0.6	8.3	36	81	18000	2200	310	0.75	**94**	32	1.5	17	0.03	42	90
	5-10 CM	17000	7.3	50	<0.5	1500	0.45	7.7	39	30	19000	2600	270	0.55	36	14	0.85	16	0.02	45	90
	10-15 CM	20000	5.3	54	0.5	1500	0.35	8.8	43	21	21000	3100	270	0.55	30	11	0.9	15	0.03	46	95
15 Rayside	0-5 CM	7300	8.8	24	<0.5	950	0.35	4.2	14	**100**	6800	1300	64	0.55	**84**	30	1.3	9.5	0.02	19	16
	5-10 CM	5600	8.3	22	<0.5	750	0.3	3.1	13	**88**	6600	990	53	<0.5	**67**	22	1.1	8	0.02	18	12
	10-15 CM	4500	5.5	16	<0.5	700	0.25	1.4	9.5	40	4300	750	45	<0.5	28	10	0.55	7.5	0.01	14	8
16 St. Charles	0-5 CM	15000	1.9	42	<0.5	4700	<0.2	8.9	39	21	20000	4900	250	<0.5	29	8.5	0.3	26	0.02	46	35
	5-10 CM	17000	1.8	41	<0.5	3800	0.25	8.5	40	17	22000	4400	190	<0.5	26	8	0.35	23	0.02	47	30
	10-15 CM	18000	0.95	41	<0.5	3900	<0.2	9.8	44	19	22000	4900	200	<0.5	30	6	0.3	23	0.02	46	28
17 Skead	0-5 CM	11000	**32**	52	<0.5	1400	0.45	9.1	25	**200**	17000	1700	120	0.65	**160**	42	1.8	15	0.04	34	33
	5-10 CM	15000	8	40	<0.5	1500	0.35	5.3	26	45	15000	1800	150	<0.5	32	13	0.8	17	0.03	37	29
	10-15 CM	16000	5.2	43	<0.5	1600	0.4	6.5	29	22	15000	2100	180	<0.5	29	10	0.7	17	0.04	38	32
18 Sturgeon Falls	0-5 CM	24000	1.9	160	0.7	4800	0.7	12	**75**	28	23000	7500	380	<0.5	**47**	25	0.55	37	**0.09**	49	64
	5-10 CM	26000	2	180	0.75	5300	0.4	15	**88**	23	30000	9200	450	<0.5	**45**	13	0.3	41	0.03	60	58
	10-15 CM	27000	1.5	180	0.75	6100	0.25	15	**93**	22	32000	10000	500	<0.5	**46**	13	<0.2	47	0.02	65	57
19 Ramsey Lake	0-5 CM	7400	**28**	160	<0.5	2300	**1.4**	**34**	31	**980**	23000	2500	120	1	**1000**	99	**16**	21	0.06	26	62
	5-10 CM	8800	17	74	<0.5	1700	0.6	13	26	**350**	16000	2300	110	0.65	**300**	39	**2.9**	20	0.03	28	43
	10-15 CM	13000	7.9	68	<0.5	1900	0.4	12	32	**140**	16000	3000	140	<0.5	**140**	18	1.6	22	0.03	31	60
20 Temagami	0-5 CM	7200	4.4	72	<0.5	2100	0.25	3.3	18	34	9900	1400	100	<0.5	35	27	0.45	19	0.02	29	20
	5-10 CM	15000	4.4	41	<0.5	1900	0.3	5.2	31	12	22000	2300	130	<0.5	20	8	0.3	18	0.02	48	24
	10-15 CM	20000	3.7	44	<0.5	2100	0.25	8.3	38	15	22000	2900	160	<0.5	28	7	0.45	19	0.03	45	30
21 Tilton Lake	0-5 CM	12000	**30**	110	0.75	2500	**1.9**	**57**	31	**500**	19000	2300	1800	1.2	**520**	82	**4.6**	24	0.05	33	110
	5-10 CM	15000	17	69	0.55	2200	0.75	**31**	38	**160**	19000	3200	950	0.95	**110**	25	1.7	21	0.02	42	80
	10-15 CM	17000	9	64	<0.5	2100	0.45	21	44	79	21000	4100	380	0.6	**69**	15	1.1	18	0.02	43	79
MOE Guidelines	Table F	NG	17	210	1.2	NG	1.0	21	71	85	NG	NG	NG	2.5	43	120	1.9	NG	NG	91	160
	Table A	NG	20	750	1.2	NG	12	40	750	225	NG	NG	NG	40	150	200	10	NG	NG	200	600
	OTR_{98}	30000	NG	NG	NG	55000	NG	NG	NG	NG	35000	20000	2200	NG	NG	NG	NG	64	0.079	NG	NG

Sulphur data are presented as a percentage. All other data are presented as dry weight concentrations in ug/g. Data in bold exceed the MOE Table F Background Guidelines (see Appendix E) or OTR_{98} Guidelines (see Appendix F) where Table F Guidelines do not exist. Data in bold and underlined exceed the MOE Table A Effects Based Guidelines (see Appendix E). For previous years of Sudbury Regular data, see Reference 21. NG = no guideline established for that element.

Table 2: Metals Concentration in Birch Foliage Collected at 21 Stations in the Sudbury Area, 1999 Regular Survey Results

Station	Al	As	Ba	B	Be	Ca	Cd	Cl	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Ni	Pb	Se	Sr	S	V	Zn
1	30	<0.2	87	17	<0.2	6500	0.7	0.002	0.7	0.55	4.6	170	0.69	2800	410	0.25	1.7	1.1	<0.2	32	0.08	<0.5	140
2	82	<0.2	91	56	<0.2	8000	0.7	0.033	0.55	0.55	7	150	0.95	3000	1100	<0.2	23	2.3	<0.2	34	0.12	<0.5	130
3	37	<0.2	110	27	<0.2	8400	0.55	0.006	0.65	<0.5	6.1	73	0.96	2400	870	<0.2	15	1.8	0.25	37	0.11	<0.5	130
4	26	<0.2	300	24	<0.2	8100	1	0.003	0.8	<0.5	6.2	61	0.76	2600	750	<0.2	5.8	1.2	<0.2	37	0.13	<0.5	160
5	45	<0.2	170	34	<0.2	6500	**1.2**	0.002	0.5	<0.5	5.8	100	0.6	2100	1900	0.25	14	1.2	<0.2	41	0.1	<0.5	190
6	58	0.3	67	36	<0.2	7700	0.65	0.033	0.85	<0.5	15	140	0.72	2300	370	<0.2	**50**	3.7	**0.65**	33	0.12	<0.5	140
7	29	<0.2	79	26	<0.2	7200	0.3	0.002	0.4	0.55	5.5	67	0.98	1700	260	<0.2	3.6	1.1	<0.2	25	0.11	<0.5	150
8	34	<0.2	100	22	<0.2	6100	0.55	0.002	0.75	<0.5	5.2	65	0.84	2200	830	<0.2	8.3	0.9	<0.2	28	0.12	<0.5	170
9	89	<0.2	160	30	<0.2	6100	0.75	0.01	0.55	0.55	5.7	140	0.68	1800	1400	0.25	15	<0.5	<0.2	24	0.1	<0.5	170
10	33	<0.2	190	23	<0.2	9000	0.85	0.002	0.25	<0.5	5.6	67	1.2	2100	1300	0.25	1.7	2	<0.2	69	0.13	<0.5	250
11	110	<0.2	85	26	<0.2	7300	0.6	0.005	0.35	<0.5	6.9	230	0.99	2000	350	<0.2	9	0.6	<0.2	19	0.12	<0.5	230
12	32	<0.2	95	25	<0.2	7500	0.4	0.002	0.3	<0.5	6.2	79	0.67	2700	420	<0.2	8.4	0.85	<0.2	26	0.11	<0.5	130
13	40	<0.2	56	33	<0.2	5500	0.45	0.003	0.35	<0.5	5.7	65	0.87	1700	430	<0.2	4.2	1.1	<0.2	22	0.1	<0.5	140
14	39	<0.2	110	43	<0.2	12000	0.5	0.019	0.55	<0.5	7.4	88	1	2200	630	0.35	10	2.7	<0.2	31	0.11	<0.5	210
15	37	<0.2	52	29	<0.2	5200	0.65	0.002	0.4	<0.5	11	82	0.78	1800	490	<0.2	**33**	1.8	0.5	47	0.14	<0.5	110
16	170	<0.2	58	14	<0.2	6400	0.4	0.043	0.45	1.1	6.4	270	0.73	2700	310	<0.2	6.5	0.9	<0.2	35	0.12	0.65	95
17	73	<0.2	130	21	<0.2	6300	1	**0.74**	1.3	0.6	7.9	130	1.4	1700	1800	<0.2	**35**	2	0.4	41	0.11	<0.5	77
18	41	<0.2	130	30	<0.2	8600	0.7	0.002	0.75	0.65	7	93	0.74	3300	1600	<0.2	3.2	0.6	<0.2	45	0.14	<0.5	220
19	22	<0.2	41	22	<0.2	4000	0.2	0.011	0.65	<0.5	12	58	1.5	1100	150	<0.2	29	2.1	**0.7**	8.3	0.08	<0.5	44
20	290	<0.2	64	28	<0.2	6200	0.5	0.003	0.6	1.5	6	**520**	0.79	2800	880	<0.2	6.3	1.1	<0.2	15	0.11	0.9	140
21	44	<0.2	59	29	<0.2	5100	0.5	0.003	0.6	<0.5	8.1	90	1.2	1500	1400	<0.2	**31**	1.7	0.3	17	0.11	<0.5	140
ULN	500	2	NG	75	NG	30000	1	0.15%	2	8	20	500	NG	7000	NG	1.5	30	30	0.5	NG	0.4%	5.0	250

Values are means of duplicate samples reported as ug/g dry weight, except chlorine and sulphur which are expressed as percent.
Values shown in bold type indicate concentrations in excess of ULN Guideline. (See Appendix G). NG = no guideline has been established for that element.

Table 3: Metals Concentration in Grass Forage Collected at 21 Stations in the Sudbury Area, 1999 Regular Survey Results

Station	Al	As	Ba	B	Be	Ca	Cd	Cl	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Ni	Pb	Se	Sr	S	V	Zn
1	38	1.1	25	3	<0.2	2300	<0.1	0.42	0.25	<0.5	3.1	110	1.3	1400	270	0.3	1.3	<0.5	<0.2	11	0.13	<0.5	26
2	56	0.3	42	3	<0.2	2300	<0.1	0.66	0.25	0.55	2.4	100	1.4	1000	140	<0.2	8.4	0.75	<0.2	14	0.1	<0.5	13
3	52	<0.2	50	4.5	<0.2	3500	<0.1	0.16	<0.2	<0.5	5.1	86	2.1	1300	160	0.35	8.1	<0.5	<0.2	12	0.11	<0.5	15
4	150	<0.2	53	3.5	<0.2	2800	<0.1	0.43	<0.2	0.85	5.4	240	1.6	1100	290	<0.2	5.9	0.85	<0.2	9.2	0.14	0.85	25
5	58	<0.2	20	5.5	<0.2	3000	<0.1	0.72	0.45	<0.5	5.4	200	1.9	910	830	<0.2	12	<0.5	<0.2	12	0.1	<0.5	24
6	31	0.3	36	3	<0.2	3900	<0.1	0.52	0.3	<0.5	3.2	86	1.3	460	250	0.4	26	0.65	<0.2	11	0.16	<0.5	20
7	20	<0.2	27	6	<0.2	4000	<0.1	0.57	0.25	<0.5	5.5	76	1.6	1100	56	0.9	2.4	<0.5	<0.2	15	0.16	<0.5	25
8	20	<0.2	39	2	<0.2	2200	<0.1	0.58	0.25	0.55	3.6	57	1.7	630	800	0.4	3.3	0.9	<0.2	10	0.14	<0.5	30
9	100	<0.2	41	3.5	<0.2	2000	<0.1	0.31	0.25	0.55	4.9	170	1.5	710	370	<0.2	9.7	<0.5	<0.2	7.9	0.13	<0.5	25
10	240	<0.2	78	3	<0.2	4000	0.15	0.2	0.3	0.75	5.8	330	1.8	1500	63	0.35	1.9	<0.5	<0.2	27	0.19	0.65	33
11	63	<0.2	23	2	<0.2	1400	<0.1	0.26	<0.2	0.7	2.8	140	1.4	500	150	<0.2	5.6	1.7	<0.2	6.6	0.06	<0.5	22
12	82	<0.2	50	4	<0.2	4600	<0.1	0.24	<0.2	0.55	7.6	180	2	2000	85	0.25	5.6	0.75	<0.2	19	0.25	<0.5	31
13	120	<0.2	34	4.5	<0.2	2500	<0.1	0.34	0.35	<0.5	4.5	210	0.91	490	170	<0.2	3.7	2.2	<0.2	14	0.08	<0.5	17
14	13	<0.2	39	5	<0.2	3700	0.15	0.66	<0.2	<0.5	4.4	46	2.5	1500	240	0.55	8	<0.5	<0.2	8.9	0.22	<0.5	36
15	260	0.4	18	3	<0.2	1400	<0.1	0.002	0.3	0.7	5.2	290	0.56	370	70	<0.2	10	1.1	<0.2	5.5	0.12	0.75	16
16	88	<0.2	5.5	4.5	<0.2	3700	<0.1	0.37	<0.2	0.65	3	160	1.3	1100	34	<0.2	0.95	0.65	<0.2	11	0.09	<0.5	12
17	110	0.25	20	6.5	<0.2	1900	0.25	0.49	0.7	0.6	9.3	260	1.8	790	630	0.55	20	1.6	0.25	6	0.11	<0.5	34
18	53	<0.2	17	6	<0.2	5900	<0.1	**1.3**	<0.2	<0.5	3.9	120	2.4	2300	88	1.2	0.85	0.85	<0.2	14	0.19	<0.5	16
19	15	<0.2	14	4	<0.2	2400	<0.1	0.43	0.25	<0.5	7.9	89	1.3	760	62	0.4	4.2	1.1	0.25	10	0.1	<0.5	10
20	270	0.25	24	4.5	<0.2	2900	<0.1	0.42	0.35	1.2	4.8	**520**	1.2	1500	380	0.45	4.1	<0.5	<0.2	7.7	0.12	0.75	42
21	52	<0.2	33	3.5	<0.2	3200	<0.1	0.53	0.55	<0.5	3.3	120	1.7	730	480	0.85	**27**	<0.5	<0.2	19	0.17	<0.5	28
ULN	NG	8	NG	20	NG	NG	2	1	8	5	20	500	NG	NG	NG	6	25	20	0.5	NG	0.5	6	100

Values are means of duplicate samples reported as ug/g dry weight, except chlorine and sulphur which are expressed as percent.
Values shown in bold type indicate concentrations in excess of ULN Guideline. (See Appendix G). NG = no guideline has been established for that element.

Table 4: Arsenic Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**250**	**290**	**220**	**100**	**260**	-	-	**380**	**120**	15	**340**	-	**234**	**93**	**49**	**40**	**300**	-
23	**300**	**510**	**160**	**82**	**57**	-	-	**91**	**120**	**110**	**120**	-	**54**	**37**	**55**	**46**	**120**	-
24	**130**	13	**24**	1.6	**160**	-	-	2.8	**23**	3.3	**350**	-	7	1.8	7.2	2.4	**200**	-
25	16	2.5	**37**	6.8	9.4	-	-	0.9	16	2	6.7	-	5.6	0.83	7.7	1.7	2.2	-
26	15	12	**27**	12	10	-	0.4	5	2	7.2	5.6	-	-	2.4	2.3	3.1	3.2	-
27	**29**	**19**	16	**95**	12	14	-	3.6	5.3	42	3.5	8.8	4	2.2	6.2	17	3.4	4.7
28	5.6	15	14	-	6.4	-	0.4	7.4	6.1	-	3.9	-	-	2.7	4.2	-	2.6	-
29	14	**470**	**170**	**210**	5.7	**92**	-	**380**	**95**	**110**	3.5	**81**	-	**310**	**43**	**100**	-	**78**
30	**350**	**46**	**51**	4.1	3.5	**57**	-	**30**	**45**	1.5	2.5	**84**	**29**	2.5	**19**	1.4	2.1	**110**
31	**87**	**18**	**36**	**24**	**50**	17	-	**19**	**32**	**40**	**32**	6.9	9.2	12	**20**	41	10	3.2
32	**43**	13	**22**	**19**	**61**	-	-	2.9	5.2	5	14	-	4	2.1	3.4	4.2	6.9	-
33	**33**	14	**20**	13	7.2	**54**	-	3.7	3.5	11	9.8	15	6.4	2.8	2.4	7.4	**18**	14
34	**18**	**25**	**20**	**20**	**19**	**22**	-	12	7.9	14	6.4	8.4	4.2	6.6	3.4	5.7	7.6	5.7
35	17	6.1	9.4	3.8	14	2.1	-	2.1	2.6	2.6	5.4	2.3	2.4	1.8	1.9	2.3	2.5	2.4
36	**31**	**140**	**150**	**140**	**120**	-	-	**120**	**230**	**160**	**68**	-	8.6	**120**	**390**	**100**	**28**	-
37	**35**	**29**	**40**	1.5	11	-	-	**32**	11	1	4.3	-	2.8	**32**	3.2	1.2	2.4	-
38	**44**	11	**25**	3.6	12	-	-	2.8	14	1.9	16	-	11	1.5	7.4	1.6	15	-
39	**60**	2.3	**26**	**19**	17	**18**	-	1.9	4.1	2.9	5.2	3.7	3.4	2.1	2.5	2.1	3.2	2.3
40	**20**	3.4	**18**	5.3	2.1	-	-	0.97	5	2.9	2.5	-	5.4	0.83	2.9	1.7	3	-
41	**29**	6.6	4.1	5.9	1.4	-	-	4.2	1.5	8.7	0.9	-	2.4	3.9	1.3	8.7	0.87	-
42	14	1.5	11	3.7	5.2	-	-	1.1	2.7	2.9	4	-	2.4	1.1	8.1	2.9	5.6	-
43	4.6	3.2	**19**	14	7.3	14	-	0.97	5.8	5.5	3.3	5.3	2	1	5.8	2.3	1.9	2
44	**38**	**88**	**71**	7.2	**61**	**130**	-	**46**	**18**	**18**	**54**	**76**	**22**	**43**	**18**	**21**	**22**	**77**
45	**36**	17	4.1	3.7	**67**	-	-	**24**	12	1.9	**51**	-	**34**	**22**	**24**	2	**35**	-
46	**130**	**28**	**35**	6.4	14	9.1	**28**	5.3	9.3	4	16	8	-	2.1	5.3	2.9	**23**	7.4
47	-	**26**	**41**	14	-	-	-	3.5	7.2	15	-	-	-	3.3	15	8.4	-	-
48	**32**	5.6	3.6	4	**27**	**21**	**21**	5.7	2.7	3.1	**29**	**22**	-	7	2.1	1.1	**30**	**18**
49	16	3.6	10	17	7.4	13	8	2.3	5	2.3	2.2	**23**	-	1.7	4.3	1.6	2.6	**36**
50	**20**	11	**75**	6.7	7.5	8.9	6.2	**27**	**63**	3.4	2.3	5.6	-	**31**	17	1.7	1.7	4.8
51	**31**	11	5.9	-	-	-	7.4	1.4	1.3	-	-	-	-	0.83	1.5	-	-	-
52	**32**	**25**	11	3.9	5.1	2.2	-	13	9.6	2.9	0.95	2.3	**23**	13	10	2.8	0.75	2
53	**120**	**22**	**33**	16	12	-	-	**18**	**24**	17	15	-	-	17	11	8.5	9.5	-
54	2	2.6	9.1	**23**	-	**38**	-	1.1	12	6.8	-	15	3.8	1	14	3.6	-	7.1

Table 4: Arsenic Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	**32**	**55**	**18**	5	8.3	**48**	-	10	4.8	1	2	5.7	6.6	6.1	3.5	0.63	1.3	2.8
56	**35**	7.7	**18**	7.2	16	-	-	4.5	3.5	2.3	1.8	-	4	4.5	3.1	1.2	1.7	-
57	**83**	3.6	1.5	0.77	9	-	-	2.2	1.5	0.64	8.6	-	9.8	1.4	1.9	0.68	9.3	-
58	7.4	8.1	2.3	8	5.8	6.7	-	3.4	2.7	3.1	3.7	4	5.4	2	5.4	2.7	2.7	3.4
59	2.4	3	13	2.3	5.1	3.6	-	1.6	6.8	2	4.7	3.3	8.6	1.3	6	2	4	2.9
60	13	4.6	3.3	2.1	4.7	9.9	-	2.6	3.6	2.3	3.1	6.7	8.6	1.8	3.6	1.9	-	4
61	6.6	3.8	4.6	3.5	4.7	3.8	-	1.4	2.2	2.3	-	3.1	4.2	0.9	1.8	1.9	-	2
62	**31**	2.4	**21**	1.4	9	3.4	-	1.9	5.6	1.3	4.5	1.9	9.2	1.6	3.7	1.3	3.5	1.7
63	9.2	5.4	11	6.7	6.8	17	-	5.5	12	4.5	2.3	5	2.8	6	12	5.4	2	4.5
64	**24**	12	**18**	11	12	**24**	-	2.9	3	9.1	2.8	12	4	1.4	2	4.8	1.5	5.8
65	14	**82**	**19**	**24**	14	**26**	-	**19**	2.2	3.4	5.2	6.2	11	3.7	2.7	3	2.5	2.7
66	**38**	**26**	**23**	3.7	3.3	-	-	7.7	3.2	4.5	3.2	-	5.4	4	2.1	4.2	2.8	-
67	10	11	3	6.5	5	3.8	-	5.1	2.7	4.3	6.5	3.6	3.8	2.7	2.1	2.5	-	3.3
68	5.4	3.7	2.4	4.9	-	3.5	-	1.9	1	5.2	-	1.9	4	1.4	1.3	4.7	-	1.4
69	6.8	2.6	5.2	4.7	6.2	4.2	-	1.7	2.5	1.2	3.9	2.6	3.8	1.6	2	0.62	3.6	2.9
70	6.4	3.2	2.4	2.7	1.6	5.9	-	2.8	2	2.1	1.3	3.4	3.4	2	2.6	2	1.5	2.7
71	4	2.8	2.7	3.1	1.2	-	-	3	1.9	2.8	0.96	-	3.4	2.8	1.7	2.5	1.1	-
72	4	7.3	32	2.7	3.6	**25**	-	2.7	**32**	2.1	**31**	**19**	3.8	2.9	**34**	2.1	3.1	13
73	15	3.2	**23**	8	-	6.8	-	2	9.4	4.2	-	7	6.4	1.3	6.7	2.7	-	7.2
74	**24**	13	**32**	17	**25**	**23**	-	2.5	5.7	8	2.7	8.2	12	1.1	2.6	3.2	2.7	7.9
75	**24**	**21**	**52**	11	**42**	**25**	-	**21**	8.1	9.5	5.6	5.9	**36**	16	5.1	5.3	2.8	2.9
76	-	**18**	10	3.5	-	-	-	3.5	5.5	1.7	-	-	-	3.5	6.2	1.9	-	-
77	7.2	**20**	**21**	12	9.2	5	-	4.3	6.8	5.6	2.9	4.5	**36**	2.9	4.7	4.1	2.7	4.1
78	2.4	2.2	16	9.8	-	**25**	-	4.9	5.5	4.4	-	5.8	4	3.2	4.4	5.4	-	4.8
79	**23**	**19**	**36**	**22**	-	-	-	2.3	3.1	4.7	-	-	**18**	1.8	2.6	2.9	-	-
80	**160**	50	**43**	**54**	**42**	**62**	-	**41**	**43**	**47**	**45**	**66**	5.4	**77**	**22**	**61**	**45**	**76**
81	**72**	12	10	3.8	12	16	-	13	8.5	4.1	8.6	**22**	10	14	6.2	3.5	4	**19**
82	17	**25**	**23**	2.7	3.7	**18**	-	5.3	17	2.1	1.7	5.6	**23**	5.3	11	2.2	0.95	7.4
83	-	-	12	-	2.7	-	-	-	6	-	1.8	-	-	-	6	-	1.5	-
84	-	17	**22**	-	-	-	-	3.2	**22**	-	-	-	-	2.5	**22**	-	-	-
85	**29**	16	13	15	14	-	-	11	9	7.6	**18**	-	12	9.1	7.6	3.4	15	-
86	**37**	2.5	3.5	3.2	3.5	-	-	2.2	3.2	2.9	3.3	-	12	2.5	3.2	3.6	-	-

Table 4: Arsenic Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
87	**20**	**52**	**69**	**29**	14	**61**	-	-	**74**	**24**	6.6	**63**	-	-	**50**	**30**	4.6	**27**
88	11	16	**18**	2.7	12	**30**	-	15	**22**	2	4.8	**33**	9.8	14	**20**	2	3.2	**21**
89	**23**	**48**	3.5	-	2.8	12	-	**33**	6.1	-	2	9.5	11	9.1	4.1	-	1.4	9.9
90	**27**	12	8.6	-	**25**	12	-	10	8.6	-	8.2	6.2	15	8.7	9.2	-	4	3.6
91	**25**	15	**48**	-	**32**	**42**	-	7.4	**61**	-	3.9	17	6.6	4.6	**57**	-	2.2	8.3
92	**19**	14	10	-	11	-	-	6.3	5.2	-	5	-	6.4	4.4	4.9	-	2.1	-
93	8.6	5.8	2	9.3	6.5	7.8	-	4.4	2	6.8	5.8	4.8	6.8	1.5	1.5	4.7	4	3.4
94	17	4.6	3.5	2.3	5.1	4.7	-	3.9	2.7	4.3	2.7	5.2	2.4	3.2	0.9	2.4	1.3	2.7
95	15	9.9	3.4	5.8	2.4	6.4	-	5.6	2.3	5.7	2.2	4	4.8	2.8	3.2	4.7	1.2	1.9
96	**44**	**29**	3.8	**27**	12	**36**	**28**	13	4.9	**49**	4.6	**40**	-	3.2	8	**61**	4.6	**51**
97	**290**	**280**	**39**	10	**57**	13	-	**91**	15	9.1	**73**	**20**	**42**	**82**	12	11	**94**	**39**
98	**42**	2	7.6	7.4	**18**	**27**	0.4	6.3	4.9	9.3	7.5	17	-	4.4	4.6	9.4	4.4	3.5
99	**42**	**26**	**44**	5.7	**47**	**25**	0.8	2.8	7.3	2.6	5.6	14	-	1.4	3.2	1.9	4	8
100	**20**	12	3.4	1.8	6.6	**27**	-	1.4	2.9	1.7	3	6.1	1.4	1.5	2.7	1.9	2.5	2.3
101	6.6	7.6	6.2	9.6	14	**29**	-	7.4	4.5	4.7	3.9	14	3.2	4.7	4.7	2.7	3.5	11
102	5.2	11	4.1	5.3	5.7	11	-	11	9.1	3	3.2	5.8	3.4	4.3	3.3	2.4	3.7	3.5
103	2.2	2.7	3.9	6.3	4.1	5	-	2.4	3.6	3.3	3.1	3.9	2.4	2.7	3.6	2.9	3.2	3.4
104	1.4	2.7	3.9	4.5	3.9	3.7	-	2.8	3.4	4.2	1.6	3.1	2.2	2.4	3	4.3	2.2	2.5
105	4.2	1.9	3	2.8	4.5	3.2	-	1.6	2.7	3.1	2.5	3.3	3.6	1.7	3	2.5	2.6	3.1
106	-	-	**18**	12	**29**	**25**	-	-	7.6	2.7	4.7	14	-	-	3.7	2.8	3	8.5
107	4	**33**	**27**	2.8	-	**67**	-	12	**21**	2.8	-	**53**	4	12	**20**	2.8	-	**49**
108	**27**	**21**	8.9	5.7	7.5	12	-	**34**	8.4	2.4	2	13	8	**25**	6.9	1.4	1	9.6
109	**18**	**22**	17	6.7	7.7	**19**	-	6.1	7.3	4.4	7.4	4.6	**18**	4.6	5.7	2.5	4.8	4.6
110	17	**33**	5.7	15	3.9	-	-	4.8	13	16	2.7	-	6.4	3.6	**44**	17	2.6	-
111	**37**	12	6.1	10	1.8	12	-	8.3	8.4	10	1.7	6.1	13	8.2	4.5	6.3	1.8	5.3
112	**19**	14	11	2.7	2	7.6	-	7.3	4.1	2.8	2	4.9	5.4	3.6	2.4	1.9	2.1	3.7
113	4.8	4.9	1.3	2.2	4.9	3.6	-	2.1	1.4	2.6	5	3.7	5.4	1.5	1.6	2.6	4.7	3.3
114	2.4	1.4	2.8	2.4	4.8	-	-	1.1	1.9	1.7	2	-	3.8	1.1	1.7	2.2	2	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 17 ug/g As. Values in bold and underlined exceed the Table A Soil Clean up Guideline of 20 ug/g As.

Table 5: Cobalt Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**29**	**44**	**27**	18	**41**	-	-	**23**	17	15	**32**	-	16	17	18	14	**23**	-
23	**36**	**45**	**24**	**23**	**23**	-	-	20	19	**23**	**33**	-	18	10	15	16	**28**	-
24	**25**	6	7.7	9.7	**23**	-	-	4.3	7	8.3	**26**	-	7	5.3	6.7	9	16	-
25	5	8	8.3	6	5	-	-	7.5	7.3	8	3.2	-	10	4.3	7.3	8	6.5	-
26	8	3.7	7.3	8.3	4.3	-	8	5.3	5.7	8.3	3.4	-	-	7	5	8.3	6.3	-
27	8	12	9	20	6.8	7.1	-	12	9	14	7.3	6.3	12	7.7	9	12	8.3	9.3
28	7	10	9.3	-	4.8	-	7	7	9	-	4.3	-	-	7.7	9.7	-	9.4	-
29	**35**	**39**	16	**23**	12	18	-	**30**	13	18	8.4	15	-	18	14	19	-	12
30	**25**	**30**	9.7	12	9.3	21	-	13	11	11	7.2	16	11	15	11	11	7.7	17
31	10	16	16	13	**22**	5.8	-	12	11	11	6.2	4.3	8	12	9	12	6.7	5.6
32	6	7	4	11	10	-	-	9.3	4.3	11	3.6	-	11	10	9	11	5.7	-
33	9	8.7	7.7	15	11	16	-	10	7.7	12	12	9.3	10	13	9.7	11	13	12
34	6	13	5	12	7.9	10	-	13	3.3	10	10	7.6	11	14	4.3	11	11	7.7
35	6	11	8.7	11	3.9	6.4	-	10	11	11	1.7	6.3	3	9.3	11	11	5.4	6.2
36	6	**60**	**59**	**37**	**39**	-	-	**41**	**25**	**39**	20	-	6	**28**	21	**30**	11	-
37	-	15	6	6	7.9	-	-	14	4.7	7	4.7	-	6	12	7.3	7	5.1	-
38	7	11	11	9	9.4	-	-	12	10	8.3	11	-	6	10	10	8.3	8.1	-
39	6	10	6	9.7	6.1	5.3	-	8	3.3	7	2.1	3.4	4	13	3.3	8.7	4.9	4.9
40	6	10	6	7.7	5.1	-	-	9.3	4.7	8.7	5	-	5	7	5.7	9	4	-
41	7	10	9	9.7	5.1	-	-	8.7	8	8.7	4.8	-	5	7	8	8.3	4.4	-
42	3	6	16	14	6.4	-	-	5	7	14	6.4	-	4	8	8.3	14	8.1	-
43	4	5	9.3	12	6.6	8.9	-	8	8	9	4.2	6.1	4	7	6.7	8.7	4.2	4.9
44	11	**39**	**33**	14	35	**90**	-	**35**	15	18	11	**35**	8	21	15	**24**	6.1	17
45	10	14	10	11	**22**	-	-	**21**	9.3	11	10	-	7	15	9	11	8.6	-
46	**33**	13	6.7	9	8.1	4.5	10	9.3	4.3	7.7	7.5	4.3	-	8.7	4	8	9.2	3.7
47	-	13	12	10	-	-	-	8.7	7.7	10	-	-	-	14	4.7	9.7	-	-
48	**28**	12	7.7	14	**33**	**36**	17	7.7	7.3	11	**23**	**26**	-	7	7.7	8.7	**26**	17
49	21	11	**28**	15	7.8	15	11	15	**29**	11	3.3	19	-	18	**31**	10	3.6	24
50	18	13	21	8.3	3.7	4.5	8	14	**44**	8.7	2.5	3.4	-	14	**37**	10	2.5	3.7
51	11	7.7	5	-	-	-	6	5	4.7	-	-	-	-	6	7.7	-	-	-
52	**26**	**29**	19	19	16	8.9	-	**26**	20	16	5.6	8.7	10	**24**	**26**	18	5.3	8.2
53	**31**	**42**	**22**	21	15	-	-	**35**	**25**	**23**	16	-	-	**31**	**26**	**22**	17	-
54	9	6	12	19	-	**22**	-	6	12	13	-	16	11	9.3	10	14	-	11

Table 5: Cobalt Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	12	**22**	7	13	14	**32**	-	10	6.7	13	10	6.5	10	11	5.3	14	9.5	6.8
56	13	7	7.3	13	10	-	-	4.3	4	10	5.8	-	8	9.3	6.7	9.7	6	-
57	11	8.7	8.3	9.7	9.7	-	-	10	8.7	10	12	-	8	10	11	10	9.8	-
58	5	12	11	20	13	14	-	9.3	10	17	12	10	6	9.3	12	14	10	9.2
59	**50**	10	**83**	12	11	9.9	-	8.7	76	12	7.8	8.9	**75**	7.7	**64**	13	8.7	10
60	8	8.7	18	13	12	7.6	-	10	**22**	13	14	6.9	5	13	**22**	13	-	8.9
61	15	18	**24**	19	14	12	-	17	18	17	-	12	15	17	14	16	-	13
62	**23**	14	**36**	8.3	**26**	5.2	-	12	**26**	8.7	**24**	6.9	13	11	20	8	18	6.4
63	8	19	18	19	16	20	-	18	20	20	17	14	5	19	18	18	21	14
64	20	12	19	20	16	16	-	8	18	17	9.7	11	13	8.7	15	17	9.8	8.2
65	10	**74**	14	**25**	11	16	-	**25**	14	13	8.5	5.7	8	18	15	15	8.4	5.6
66	**23**	**62**	18	12	13	-	-	**24**	8	16	12	-	13	17	9.3	16	10	-
67	5	10	8	12	9.6	7.9	-	6	9.3	8.3	10	7	10	8.7	11	7.3	-	6
68	5	4.3	9.7	20	-	5.3	-	5	8.7	**22**	-	4.4	5	8	10	16	-	5.4
69	13	7.7	**22**	**24**	11	11	-	9.3	17	**24**	10	9.5	18	13	16	**24**	11	9.1
70	20	20	14	14	13	4.4	-	19	12	12	12	6.3	18	17	13	14	13	8.4
71	5	9.3	10	14	7.8	-	-	8.7	9.7	14	7.3	-	5	10	9.7	16	7.6	-
72	8	16	**39**	21	20	**61**	-	13	**40**	18	16	**54**	4	14	**40**	16	15	**49**
73	13	12	16	14	-	16	-	9.3	9.3	13	-	16	8	8.7	12	12	-	13
74	11	18	**32**	**25**	**30**	21	-	11	9.3	12	8.1	7.6	12	8	10	16	7.6	8.2
75	-	17	**23**	20	**33**	**38**	-	17	6.3	15	9.9	15	20	15	6	12	9.1	15
76	-	14	**24**	13	-	-	-	4.3	15	9.7	-	-	-	5	16	9.7	-	-
77	10	8	11	10	9.8	6.5	-	5	5.7	7.3	4.9	5.1	8	3.7	4.7	6.7	4.3	4.6
78	15	20	17	10	-	20	-	13	19	11	-	17	10	12	16	8.3	-	16
79	15	19	17	15	-	-	-	15	8.7	10	-	-	10	14	8	10	-	-
80	-	**24**	**22**	**25**	19	**24**	-	**25**	**28**	**24**	19	**26**	-	**36**	**26**	**29**	21	**31**
81	**28**	**23**	17	18	16	14	-	**23**	21	14	16	14	15	14	**23**	16	12	12
82	**25**	**49**	**26**	7.7	12	**34**	-	**22**	**27**	7.7	7.3	21	14	19	**24**	8.3	7.3	20
83	-	-	10	18	8	-	-	-	7.7	18	5.1	-	-	-	6.7	18	5.3	-
84	-	15	**32**	**23**	-	-	-	11	**24**	**22**	-	-	-	12	20	19	-	-
85	13	**23**	**23**	**22**	19	-	-	19	15	13	**23**	-	12	19	12	12	16	-
86	18	13	14	18	9.2	-	-	15	14	17	12	-	9	14	12	17	-	-
87	**23**	**46**	**29**	**38**	**22**	**43**	-	-	20	**35**	12	**33**	-	-	14	**39**	12	17

Table 5: Cobalt Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
88	14	**30**	16	**27**	18	**36**	-	**29**	17	**27**	12	**22**	11	**26**	14	16	9.2	15
89	7	**27**	19	**24**	14	**27**	-	15	14	13	13	**23**	8	10	16	12	11	**22**
90	14	**23**	**23**	16	21	**87**	-	19	**24**	20	10	**37**	5	15	**24**	16	8.2	18
91	**31**	**24**	21	17	21	**28**	-	16	**23**	16	7.2	11	**25**	14	**29**	16	6.7	13
92	15	**48**	21	14	17	-	-	**22**	12	15	11	-	12	19	11	16	11	-
93	7	12	7.3	11	7.3	9.7	-	10	7	7.3	6.6	5.5	9	7	6.3	7.3	6.3	4.9
94	8	12	5.7	7.7	4.8	5.6	-	12	4.7	8.3	5.1	4.3	9	13	6	7.3	5.3	3.8
95	5	13	10	10	5.7	4.4	-	9.7	10	13	6.4	4.5	6	13	10	12	6.8	6.8
96	**59**	**34**	14	**32**	**35**	**63**	**44**	**29**	14	**32**	11	**54**	-	16	17	**28**	12	**63**
97	**51**	**49**	15	**70**	**31**	**58**	-	21	14	**75**	**26**	**44**	18	20	14	**63**	**24**	**73**
98	**25**	21	20	13	10	13	6	13	18	12	7.7	7.5	-	13	19	14	7.8	6.6
99	**788**	11	21	16	**31**	**24**	**26**	8.7	13	11	6.2	14	-	9.3	13	10	6.2	12
100	**32**	10	11	9.7	9.7	13	-	6	10	10	8.4	4.5	12	7.7	9	11	8.7	5.1
101	12	**23**	2	12	6.8	14	-	17	2	10	6.4	4.8	12	13	2	9.7	6.8	4.7
102	10	**30**	16	16	11	18	-	**31**	16	14	13	17	9	**27**	17	13	18	16
103	15	16	21	17	11	17	-	15	21	16	12	16	15	18	21	16	12	15
104	15	19	**22**	19	9.3	13	-	19	**23**	21	9.3	13	12	18	**24**	**22**	11	13
105	15	14	17	15	9.6	17	-	15	18	18	10	16	**39**	17	18	17	11	17
106	-	-	**24**	**27**	**42**	**26**	-	-	16	15	13	15	-	-	11	15	9.1	12
107	15	**24**	**33**	15	-	**48**	-	14	**25**	17	-	**22**	15	19	**22**	16	-	13
108	11	**22**	12	13	6	17	-	**23**	13	12	4.7	18	5	**30**	10	11	5.4	14
109	8	20	**24**	19	15	**24**	-	15	**22**	18	11	8	8	15	20	18	11	8.5
110	5	21	**46**	16	8.3	-	-	8	**69**	12	8.4	-	10	11	**72**	13	7.8	-
111	7	18	14	16	6.1	**23**	-	15	16	14	6.1	13	8	14	16	14	5.8	12
112	6	12	13	11	5.7	15	-	11	9.7	11	6	9.7	7	8.7	12	11	6.1	8.1
113	9	11	8	12	9.3	10	-	10	8	12	9.4	8.7	8	10	9.7	13	8.3	7.5
114	10	13	12	15	6.2	-	-	12	12	14	8.2	-	13	14	13	16	9.2	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 21 ug/g Co. Values in bold and underlined exceed the Table A Soil Clean up Guideline of 40 ug/g Co.

Table 6: Copper Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	405	430	390	240	480	-	-	300	270	180	340	-	349	320	260	140	300	-
23	580	540	370	400	360	-	-	270	190	450	520	-	335	230	240	260	400	-
24	440	71	120	11	350	-	-	36	100	30	590	-	73	22	53	17	540	-
25	92	24	200	35	72	-	-	9	49	14	29	-	46	7	31	9	9	-
26	54	61	110	74	48	-	14	25	7	36	18	-	-	14	10	20	13	-
27	138	110	67	450	110	190	-	11	33	260	22	63	13	10	24	160	15	28
28	57	110	92	-	73	-	10	24	18	-	18	-	-	13	22	-	15	-
29	715	470	270	370	46	130	-	480	250	270	28	110	-	290	240	320	-	120
30	535	400	150	36	29	270	-	150	150	21	18	240	151	98	84	18	17	260
31	134	250	190	160	460	110	-	120	130	160	170	76	43	110	110	180	110	43
32	209	87	96	110	210	-	-	93	67	32	72	-	28	56	34	26	64	-
33	211	100	110	89	61	400	-	64	20	79	71	110	27	24	21	52	110	72
34	65	200	130	180	66	120	-	88	12	93	17	44	16	43	10	35	18	24
35	64	52	54	33	110	16	-	17	10	20	17	12	11	15	10	18	11	12
36	148	570	1300	970	640	-	-	430	360	870	270	-	38	270	340	610	120	-
37	-	220	150	16	100	-	-	180	43	10	37	-	28	180	33	10	27	-
38	250	97	150	28	97	-	-	33	79	15	89	-	33	18	63	15	70	-
39	188	40	200	140	150	140	-	28	17	17	24	28	18	89	18	14	21	14
40	88	40	110	42	24	-	-	5	71	26	23	-	20	7	43	13	32	-
41	193	88	45	69	28	-	-	45	16	53	10	-	13	36	14	49	10	-
42	98	26	150	61	58	-	-	9	25	47	30	-	8	10	85	36	58	-
43	33	48	160	200	94	210	-	18	66	77	38	76	13	14	50	40	15	25
44	132	350	470	80	660	920	-	460	76	180	200	470	67	290	77	260	100	370
45	159	140	48	36	430	-	-	130	93	19	190	-	145	89	120	18	150	-
46	793	240	230	66	130	72	34	47	450	47	110	59	-	24	31	38	140	52
47	-	220	270	130	-	-	-	39	42	110	-	-	-	49	68	89	-	-
48	443	190	140	290	780	690	285	140	130	150	390	600	-	130	93	88	570	520
49	375	140	290	120	200	310	253	91	260	94	120	440	-	75	210	73	96	570
50	273	180	550	74	91	110	95	230	670	35	34	65	-	230	380	19	20	59
51	193	100	46	-	-	-	64	13	13	-	-	-	-	8	14	-	-	-
52	580	300	390	82	110	49	-	330	420	70	39	48	503	420	800	54	28	40
53	1025	340	340	230	200	-	-	350	360	240	250	-	-	330	330	140	240	-
54	155	79	120	250	-	450	-	44	130	75	-	360	55	37	160	42	-	150

Table 6: Copper Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	318	600	260	130	110	840	-	120	57	61	18	93	78	74	36	43	19	59
56	325	100	210	100	130	-	-	75	89	63	69	-	35	64	64	38	71	-
57	340	57	13	23	110	-	-	30	15	25	130	-	73	15	23	22	130	-
58	53	120	25	110	100	100	-	27	33	45	45	64	25	17	69	31	32	55
59	73	76	100	40	48	50	-	43	52	31	38	40	45	38	46	31	31	31
60	63	44	37	37	65	120	-	9	32	31	38	47	22	7	36	30	-	32
61	48	48	40	47	43	38	-	18	20	32	-	30	29	17	16	27	-	23
62	39	150	320	35	230	140	-	120	140	43	140	130	205	90	51	43	67	93
63	143	160	260	180	180	300	-	180	270	140	140	180	32	190	290	100	120	160
64	39	210	250	250	220	330	-	78	80	230	51	230	39	65	47	97	29	130
65	84	760	270	660	150	440	-	280	23	43	66	84	85	51	25	38	21	34
66	460	560	340	37	57	-	-	100	26	59	43	-	31	44	21	65	37	-
67	73	170	28	57	42	39	-	16	22	58	66	37	8	10	18	30	-	33
68	22	38	39	75	-	46	-	7	16	76	-	17	12	9	17	92	-	12
69	31	30	52	52	54	37	-	14	29	22	37	17	24	13	24	19	34	21
70	28	44	17	43	22	42	-	38	16	18	26	22	22	28	20	24	22	26
71	8	24	16	43	15	-	-	17	9	40	13	-	4	14	10	37	13	-
72	53	260	530	360	200	1600	-	110	530	59	69	970	10	89	550	49	61	1000
73	158	160	340	220	-	300	-	78	190	110	-	210	58	40	120	53	-	190
74	220	330	740	540	640	490	-	63	33	98	43	69	60	25	25	34	44	38
75	-	340	820	420	810	580	-	310	290	220	91	120	450	360	180	170	50	68
76	-	270	200	120	-	-	-	53	84	53	-	-	-	34	91	41	-	-
77	135	220	220	170	150	87	-	48	58	66	42	48	35	22	32	43	19	34
78	340	350	180	110	-	310	-	82	97	44	-	98	25	40	64	42	-	72
79	163	230	250	310	-	-	-	72	73	58	-	-	25	30	43	24	-	-
80	-	510	330	620	450	760	-	360	350	510	460	700	-	710	270	610	450	810
81	660	260	190	54	200	280	-	220	260	47	220	280	393	220	200	60	150	290
82	568	560	480	210	310	950	-	230	490	100	140	400	508	270	560	91	120	360
83	-	-	210	120	74	-	-	-	74	56	19	-	-	-	75	57	18	-
84	-	230	520	460	-	-	-	89	300	390	-	-	-	68	280	370	-	-
85	223	330	300	220	260	-	-	160	120	75	310	-	83	120	95	28	240	-
86	305	35	46	92	77	-	-	31	32	52	51	-	63	35	31	62	-	-
87	940	1100	590	1000	450	1100	-	-	570	820	170	1200	-	-	390	950	140	670

Table 6: Copper Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
88	**220**	**330**	**260**	**140**	**290**	**950**	-	**320**	**250**	**100**	**92**	**640**	**143**	**340**	**240**	84	49	**520**
89	**197**	**400**	34	**450**	59	**510**	-	**290**	59	**190**	39	**320**	**120**	**110**	42	**110**	35	**290**
90	**300**	**180**	74	**240**	**370**	**470**	-	**120**	77	**370**	**140**	**220**	**112**	**110**	**92**	**230**	70	75
91	**400**	**250**	**470**	**150**	**380**	**820**	-	**120**	**480**	**100**	30	**230**	57	66	**910**	65	17	**95**
92	**176**	**430**	**150**	37	**210**	-	-	**120**	43	46	76	-	35	68	23	41	41	-
93	53	59	21	**150**	70	**160**	-	41	19	59	60	52	29	14	15	34	44	27
94	73	34	24	12	37	54	-	24	12	23	13	36	11	18	8	12	10	12
95	73	**98**	21	40	18	61	-	50	12	41	20	14	15	24	20	38	22	9
96	**2600**	**1200**	**240**	**850**	**2000**	**2800**	**1700**	**380**	**130**	**640**	**160**	**2000**	-	**110**	**260**	**690**	**210**	**2400**
97	**1007**	**720**	**540**	**810**	**560**	**1200**	-	**440**	**180**	**520**	**380**	**1200**	**120**	**350**	**150**	**350**	**380**	**1900**
98	**570**	**260**	**180**	76	**160**	**190**	22	**120**	77	76	41	**91**	-	62	67	**100**	23	55
99	52	**210**	**340**	**120**	**530**	**330**	8	49	**88**	49	69	**140**	-	19	49	36	51	79
100	**568**	**140**	46	35	**97**	**230**	-	16	36	26	43	46	28	19	35	36	33	23
101	**115**	61	69	**120**	**140**	**310**	-	55	35	38	57	79	64	27	21	20	45	34
102	**91**	**140**	29	**94**	69	**120**	-	80	**100**	40	26	59	43	32	24	34	35	37
103	**100**	21	40	**110**	38	57	-	19	31	53	27	39	25	17	33	41	24	33
104	41	30	35	57	38	37	-	29	32	44	16	22	29	19	29	37	21	19
105	71	18	65	33	33	26	-	16	67	41	21	26	47	17	63	35	20	27
106	-	-	**600**	**640**	**1300**	**980**	-	-	**190**	**110**	**170**	**320**	-	-	77	**92**	63	**190**
107	63	**290**	**820**	**100**	-	**890**	-	**110**	**560**	53	-	**640**	40	**120**	**370**	**91**	-	**590**
108	**433**	**240**	**180**	**130**	83	**290**	-	**370**	**150**	44	27	**260**	63	**440**	**140**	27	18	**210**
109	**165**	**420**	**410**	**200**	**180**	**430**	-	**160**	**97**	**110**	**100**	**96**	**183**	**86**	65	70	71	**93**
110	**198**	**360**	**180**	**480**	71	-	-	59	**230**	**440**	36	-	28	45	**470**	**410**	34	-
111	**463**	**170**	70	**180**	27	**350**	-	84	**130**	**130**	18	**150**	**88**	76	56	**89**	17	**130**
112	85	**110**	**130**	39	14	**180**	-	56	19	26	15	**86**	28	28	14	19	14	54
113	35	54	20	31	67	61	-	24	18	25	65	53	**88**	19	21	33	55	40
114	10	14	22	33	62	-	-	11	17	24	14	-	20	13	17	23	18	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 85 ug/g Cu. Values in bold and underlined exceed the Table A Soil Clean up Guideline of 225 ug/g Cu.

Table 7: Iron Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	18000	17000	25000	18000	25000	-	-	13000	14000	17000	27000	-	17300	10000	17000	16000	24000	-
23	22500	19000	21000	22000	14000	-	-	9100	18000	21000	21000	-	17000	13000	16000	19000	24000	-
24	19000	4200	7200	11000	24000	-	-	5100	9100	11000	27000	-	9100	6900	11000	11000	22000	-
25	9400	4200	12000	12000	8700	-	-	5000	10000	13000	8800	-	11300	6100	9800	11000	11000	-
26	5600	4700	7300	12000	9900	-	11000	6400	9200	12000	11000	-	-	6400	8400	12000	10000	-
27	4600	4100	10000	21000	12000	12000	-	5400	16000	21000	15000	16000	12500	9300	15000	20000	15000	19000
28	10000	6100	14000	-	6700	-	14500	6600	17000	-	9400	-	-	7200	21000	-	16000	-
29	22500	15000	15000	20000	11000	20000	-	13000	16000	18000	11000	19000	-	11000	16000	19000	-	19000
30	18500	11000	13000	13000	12000	20000	-	7400	15000	12000	11000	22000	12800	9200	13000	12000	12000	22000
31	8500	7200	13000	16000	20000	13000	-	8100	11000	14000	17000	17000	8800	7600	11000	15000	16000	15000
32	5100	5500	7800	14000	11000	-	-	11000	14000	14000	9900	-	10700	11000	13000	13000	12000	-
33	6500	4500	12000	16000	16000	18000	-	8300	14000	15000	17000	17000	13900	9100	12000	15000	12000	20000
34	3800	6900	4300	13000	14000	19000	-	9600	6500	13000	16000	16000	14700	12000	5000	17000	16000	15000
35	5300	6500	8100	13000	5600	14000	-	7100	10000	13000	6700	13000	10800	6800	10000	13000	13000	14000
36	7500	14000	24000	24000	20000	-	-	14000	17000	24000	15000	-	8100	12000	25000	20000	11000	-
37	-	6500	7200	7300	10000	-	-	6000	9900	8800	9400	-	8800	6100	12000	8300	9400	-
38	6100	4900	7800	11000	9900	-	-	5500	8700	11000	12000	-	10800	5000	8900	11000	9700	-
39	8200	4800	8200	11000	7000	9100	-	3300	9000	11000	7900	11000	6800	5500	8800	11000	12000	13000
40	6800	4300	9700	9200	8500	-	-	5500	8600	9500	8500	-	6500	4300	7500	9300	7900	-
41	8800	5400	6400	11000	9300	-	-	5100	7800	11000	8800	-	8300	5100	7400	10000	8100	-
42	3500	4100	9300	18000	10000	-	-	3900	7000	19000	9900	-	3800	4300	8600	17000	9900	-
43	4500	3500	10000	16000	9600	14000	-	4700	12000	17000	8500	12000	5000	5600	12000	16000	8400	11000
44	8900	11000	15000	9600	21000	**46000**	-	9900	8900	11000	14000	31000	5400	8900	9100	11000	13000	23000
45	3300	5400	9300	12000	18000	-	-	5900	10000	13000	15000	-	3800	6300	11000	13000	13000	-
46	100	5000	7900	9700	8400	9700	8900	4000	8700	9200	8000	9600	-	3600	9500	8900	8700	9600
47	-	8300	7600	12000	-	-	-	5600	10000	13000	-	-	-	6600	11000	12000	-	-
48	17100	7200	5100	13000	22000	17000	12800	5900	5400	12000	21000	17000	-	6400	5000	11000	22000	17000
49	18300	9600	20000	19000	11000	16000	7500	12000	18000	16000	7300	21000	-	12000	16000	14000	7500	26000
50	15000	8000	15000	8700	9200	10000	13300	8700	22000	9100	7900	10000	-	8200	21000	11000	8600	11000
51	1600	4700	11000	-	-	-	2600	3900	8500	-	-	-	-	4100	9600	-	-	-
52	18000	14000	23000	21000	19000	17000	-	14000	19000	16000	9900	16000	16000	14000	22000	19000	9900	16000
53	**40000**	19000	22000	23000	18000	-	-	21000	23000	26000	19000	-	-	19000	19000	27000	19000	-
54	8800	3900	15000	21000	-	27000	-	4600	16000	16000	-	21000	11500	6400	15000	16000	-	16000

Table 7: Iron Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	16500	19000	10000	14000	16000	26000	-	6800	15000	14000	18000	15000	23800	7100	13000	15000	17000	15000
56	14500	7100	9600	14000	15000	-	-	6400	8100	12000	11000	-	10500	6400	9900	11000	11000	-
57	15000	3800	7900	12000	13000	-	-	4400	8700	12000	14000	-	11500	4600	8200	12000	13000	-
58	9300	5000	18000	13000	19000	18000	-	5600	16000	14000	20000	18000	11000	4500	17000	13000	19000	17000
59	4800	3600	44000	17000	18000	18000	-	3000	**48000**	19000	17000	20000	**55200**	2900	**46000**	20000	17000	21000
60	10300	9400	24000	17000	18000	14000	-	14000	33000	19000	22000	15000	8500	17000	35000	16000	-	22000
61	13800	18000	25000	26000	27000	24000	-	20000	26000	27000	-	28000	17000	20000	22000	27000	-	32000
62	17500	11000	20000	12000	23000	13000	-	10000	18000	12000	31000	14000	13300	12000	17000	11000	32000	13000
63	8300	11000	11000	23000	22000	29000	-	11000	12000	25000	25000	26000	6000	11000	13000	24000	26000	26000
64	12000	14000	15000	19000	15000	17000	-	11000	13000	16000	14000	14000	9800	14000	11000	17000	16000	12000
65	13000	30000	12000	19000	18000	16000	-	21000	10000	17000	17000	11000	13300	20000	14000	21000	17000	13000
66	16500	22000	13000	16000	22000	-	-	20000	12000	20000	21000	-	13500	18000	14000	20000	20000	-
67	8300	7000	11000	13000	16000	16000	-	7900	11000	9900	17000	15000	11800	13000	11000	8900	-	13000
68	8800	3400	8300	19000	-	8200	-	6500	10000	22000	-	9200	8000	12000	12000	20000	-	11000
69	12800	6000	21000	25000	21000	23000	-	8000	19000	29000	24000	25000	18300	11000	17000	28000	24000	23000
70	18000	11000	17000	18000	25000	13000	-	11000	17000	18000	25000	22000	17500	10000	19000	21000	28000	27000
71	9300	8800	13000	18000	15000	-	-	10000	15000	20000	15000	-	13300	13000	15000	20000	14000	-
72	9500	9300	21000	22000	28000	31000	-	11000	19000	22000	29000	31000	1600	9700	20000	21000	27000	32000
73	9500	8800	14000	14000	-	17000	-	7800	11000	13000	-	18000	7500	7300	11000	11000	-	16000
74	12800	8900	14000	14000	19000	18000	-	7500	13000	12000	16000	16000	13500	5700	17000	19000	14000	18000
75	-	14000	15000	9500	22000	23000	-	14000	7100	9800	14000	19000	17800	13000	4600	8700	14000	22000
76	-	8400	15000	16000	-	-	-	3700	11000	13000	-	-	-	4400	13000	13000	-	-
77	9500	6000	11000	11000	11000	12000	-	4900	7800	9400	9300	11000	7800	4600	8100	9400	9500	11000
78	17300	10000	15000	12000	-	25000	-	8800	20000	16000	-	23000	13300	9000	20000	11000	-	24000
79	7000	11000	19000	15000	-	-	-	8900	13000	13000	-	-	12900	8700	13000	12000	-	-
80	-	14000	21000	23000	21000	24000	-	11000	21000	22000	20000	25000	-	16000	15000	25000	20000	27000
81	22000	9700	16000	27000	17000	24000	-	9800	18000	20000	13000	21000	13500	9700	16000	24000	12000	20000
82	12300	13000	26000	6600	7100	21000	-	8500	28000	8100	6200	14000	17800	8600	22000	9600	7800	14000
83	-	-	14000	17000	12000	-	-	-	13000	23000	11000	-	-	-	14000	24000	10000	-
84	-	9100	29000	25000	-	-	-	8400	22000	27000	-	-	-	9500	22000	22000	-	-
85	14500	14000	17000	18000	17000	-	-	15000	17000	16000	20000	-	14100	14000	14000	16000	18000	-
86	9300	7400	16000	21000	11000	-	-	11000	18000	22000	17000	-	9500	10000	17000	21000	-	-
87	21300	17000	21000	28000	22000	32000	-	-	23000	24000	17000	29000	-	-	16000	27000	18000	24000

Table 7: Iron Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
88	15000	14000	19000	14000	28000	33000	-	16000	21000	12000	19000	30000	15400	12000	19000	12000	16000	31000
89	7800	13000	24000	25000	25000	21000	-	10000	18000	16000	23000	20000	6500	7600	19000	16000	18000	20000
90	14000	9400	27000	26000	22000	32000	-	9200	28000	29000	17000	21000	10000	7900	28000	25000	16000	22000
91	17500	13000	20000	24000	22000	27000	-	12000	20000	23000	12000	18000	24500	10000	22000	22000	13000	23000
92	12000	17000	14000	17000	17000	-	-	16000	14000	17000	16000	-	13300	17000	14000	18000	19000	-
93	7500	5300	9200	14000	11000	15000	-	5200	8600	11000	9600	13000	8300	4900	7300	11000	9900	11000
94	6500	8400	8400	14000	10000	13000	-	9300	7600	15000	12000	11000	7500	16000	9300	13000	12000	12000
95	12300	30000	20000	25000	20000	63000	-	11000	18000	22000	21000	23000	14500	13000	18000	22000	19000	23000
96	18800	12000	11000	20000	16000	24000	17000	9800	12000	22000	15000	25000	-	7800	14000	20000	15000	29000
97	**45000**	24000	12000	**80000**	**52000**	**69000**	-	11000	16000	**63000**	**57000**	**49000**	19500	10000	11000	34000	**57000**	**59000**
98	25500	18000	22000	16000	17000	24000	9800	9100	25000	17000	13000	16000	-	8000	22000	17000	13000	15000
99	**52500**	12000	22000	21000	**43000**	34000	9000	9900	15000	15000	13000	20000	-	7700	11000	14000	14000	17000
100	21500	9200	11000	14000	20000	17000	-	6600	9700	14000	18000	11000	15700	8900	9200	15000	18000	11000
101	10900	7900	7400	15000	12000	19000	-	6500	7600	13000	18000	15000	13000	7200	9800	13000	16000	17000
102	12000	13000	17000	20000	16000	25000	-	14000	16000	20000	21000	26000	11100	15000	20000	18000	30000	28000
103	17500	14000	25000	22000	20000	27000	-	11000	27000	22000	20000	27000	18900	11000	26000	24000	22000	28000
104	18900	11000	23000	22000	17000	22000	-	12000	26000	24000	18000	23000	17500	11000	26000	24000	20000	24000
105	16500	10000	19000	21000	20000	30000	-	11000	19000	21000	20000	30000	17800	12000	19000	22000	20000	31000
106	-	-	22000	24000	30000	19000	-	-	20000	17000	21000	20000	-	-	15000	19000	18000	18000
107	19300	24000	24000	19000	-	31000	-	8400	24000	21000	-	21000	21800	8600	22000	21000	-	19000
108	7000	18000	17000	18000	11000	18000	-	17000	17000	17000	11000	19000	6800	15000	17000	14000	11000	18000
109	11000	14000	23000	19000	15000	25000	-	16000	23000	21000	15000	18000	10800	17000	22000	24000	19000	18000
110	7500	14000	30000	12000	11000	-	-	14000	31000	9200	10000	-	10800	18000	30000	10000	10000	-
111	11400	11000	12000	17000	8500	22000	-	10000	14000	16000	8600	18000	12000	9100	13000	16000	8700	17000
112	9800	7400	8600	12000	9900	15000	-	7800	10000	13000	9800	16000	11500	8600	12000	11000	10000	18000
113	9900	9500	8100	17000	16000	18000	-	11000	8600	16000	17000	17000	8400	9800	8900	17000	17000	18000
114	14800	7400	15000	25000	14000	-	-	7300	17000	28000	21000	-	19300	7100	16000	33000	22000	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
No Soil Clean-up Guidelines have been established, therefore concentrations shown in bold exceed the OTR_{98} Guideline of 35,000 ug/g Fe.

Table 8: Nickel Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	295	470	350	130	540	-	-	260	95	44	400	-	153	170	76	56	290	-
23	370	520	210	220	320	-	-	160	50	180	570	-	105	110	88	92	430	-
24	315	54	70	28	300	-	-	29	56	30	380	-	13	26	25	27	220	-
25	45	33	100	30	54	-	-	24	35	26	19	-	15	28	25	28	26	-
26	18	45	97	57	38	-	15	33	18	36	17	-	-	37	18	25	23	-
27	115	83	38	270	74	120	-	21	34	130	30	39	8	32	35	62	31	40
28	55	90	64	-	78	-	5	23	24	-	17	-	-	19	29	-	30	-
29	375	390	200	250	57	180	-	300	110	160	23	140	-	180	88	150	-	110
30	270	280	76	48	40	190	-	96	70	38	24	170	45	78	50	35	25	200
31	80	130	160	79	340	65	-	56	85	78	56	26	15	47	61	83	36	28
32	100	54	54	60	180	-	-	41	31	30	23	-	13	46	28	32	25	-
33	113	84	65	82	60	270	-	58	31	55	57	60	25	59	28	39	67	59
34	20	190	110	120	56	120	-	85	18	61	42	35	20	73	20	33	40	29
35	38	53	46	32	85	26	-	40	18	29	11	24	3	43	16	26	27	24
36	68	470	1100	550	680	-	-	360	440	750	300	-	30	310	280	460	130	-
37	-	170	67	19	96	-	-	140	37	19	26	-	25	110	28	18	25	-
38	145	79	110	34	120	-	-	30	49	22	120	-	38	31	43	23	87	-
39	110	43	120	100	130	100	-	25	16	24	18	26	15	99	15	24	30	29
40	45	54	87	38	37	-	-	43	29	34	39	-	23	37	29	35	25	-
41	100	93	45	66	37	-	-	44	26	56	19	-	23	28	24	45	18	-
42	50	46	170	60	77	-	-	25	35	47	49	-	18	22	95	43	100	-
43	35	28	120	180	97	190	-	15	23	55	34	77	18	17	23	28	25	37
44	120	410	570	73	520	810	-	400	160	150	130	300	43	200	150	330	47	130
45	140	160	45	50	310	-	-	240	66	41	110	-	105	110	87	37	72	-
46	700	160	140	52	110	53	88	33	35	39	110	46	-	25	26	36	140	39
47	-	230	180	84	-	-	-	41	36	73	-	-	-	66	40	63	-	-
48	500	200	150	310	970	950	255	120	140	140	510	650	-	130	100	49	590	390
49	293	120	410	74	130	270	140	100	520	42	33	340	-	110	630	39	31	490
50	213	160	350	72	73	94	65	220	570	45	26	51	-	210	560	34	25	49
51	178	68	58	-	-	-	48	15	35	-	-	-	-	13	41	-	-	-
52	325	250	270	73	200	77	-	240	270	50	43	78	160	180	520	72	32	70
53	625	210	290	210	180	-	-	240	230	260	210	-	-	300	220	200	230	-

Table 8: Nickel Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
54	110	27	85	240	-	360	-	20	96	75	-	180	48	28	110	55	-	81
55	188	490	100	72	270	830	-	120	40	61	46	50	58	84	38	61	40	47
56	225	89	150	90	140	-	-	63	29	52	30	-	35	54	34	47	35	-
57	188	91	13	25	130	-	-	69	15	22	160	-	35	38	25	22	150	-
58	63	110	31	83	120	130	-	54	39	41	65	79	28	48	71	33	39	71
59	80	96	90	28	51	63	-	53	50	30	45	51	40	44	43	28	39	44
60	63	66	43	31	65	110	-	29	37	29	41	42	25	36	41	26	-	40
61	33	77	40	65	48	47	-	44	26	39	-	35	30	44	24	35	-	31
62	350	73	410	41	540	49	-	72	320	42	390	53	100	78	99	40	220	50
63	88	300	280	180	140	260	-	260	320	170	140	130	25	230	230	150	260	130
64	275	200	160	260	310	320	-	55	54	260	130	220	75	63	46	160	67	130
65	88	2100	200	450	120	350	-	710	84	56	57	67	70	140	97	76	41	39
66	350	610	330	35	70	-	-	160	51	58	56	-	68	110	38	61	47	-
67	85	210	34	52	58	49	-	39	26	39	75	46	33	38	23	29	-	47
68	23	42	45	90	-	64	-	13	14	81	-	28	20	27	17	68	-	21
69	40	49	50	67	64	55	-	35	30	48	50	38	43	42	28	48	50	39
70	50	80	28	28	41	38	-	71	26	23	43	26	43	56	31	29	42	32
71	25	38	22	37	25	-	-	31	12	37	23	-	13	30	15	38	23	-
72	40	310	1600	150	310	2300	-	180	1600	54	150	2100	8	160	1600	45	80	1600
73	275	160	370	180	-	280	-	75	82	92	-	230	58	74	97	75	-	230
74	145	380	790	530	690	470	-	73	73	110	90	100	60	50	55	64	92	75
75	-	380	740	640	830	740	-	360	110	300	69	100	650	390	110	160	68	66
76	-	320	220	78	-	-	-	94	110	52	-	-	-	57	110	42	-	-
77	133	180	210	140	170	91	-	60	83	63	75	86	55	86	81	67	69	82
78	233	360	160	110	-	300	-	130	88	47	-	100	65	110	92	53	-	140
79	275	180	280	210	-	-	-	82	39	48	-	-	43	65	42	46	-	-
80	-	340	300	490	340	530	-	290	250	470	350	580	-	520	160	550	390	650
81	550	200	160	70	260	180	-	220	190	66	350	200	200	260	260	71	230	160
82	575	760	670	170	390	890	-	570	700	110	200	490	215	300	680	96	170	440
83	-	-	180	100	90	-	-	-	40	52	31	-	-	-	33	52	30	-
84	-	230	490	460	-	-	-	61	430	490	-	-	-	43	430	460	-	-
85	250	300	540	320	270	-	-	190	180	130	390	-	115	170	140	54	320	-

Table 8: Nickel Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
86	**375**	**56**	**71**	**95**	**92**	-	-	**60**	**66**	**67**	**74**	-	**113**	**69**	**68**	**71**	-	-
87	**500**	**860**	**770**	**820**	**470**	**1300**	-	-	**330**	**710**	**160**	**950**	-	-	**280**	**840**	**120**	**380**
88	**120**	**390**	**260**	**240**	**370**	**940**	-	**400**	**320**	**170**	**140**	**550**	**75**	**330**	**250**	**110**	**57**	**340**
89	**100**	**550**	**50**	**550**	**110**	**600**	-	**300**	**67**	**160**	**82**	**440**	**45**	**110**	**51**	**76**	**67**	**400**
90	**205**	**410**	**100**	**190**	**400**	**570**	-	**310**	**110**	**280**	**130**	**220**	**75**	**290**	**110**	**200**	**63**	**120**
91	**318**	**370**	**420**	**140**	**430**	**770**	-	**180**	**420**	**100**	**59**	**150**	**63**	**120**	**550**	**67**	**47**	**91**
92	**150**	**530**	**190**	36	**280**	-	-	**300**	**66**	42	**91**	-	38	**180**	38	39	**55**	-
93	**45**	**88**	26	**120**	**91**	**150**	-	**66**	26	**49**	**77**	**49**	25	31	19	35	**58**	41
94	30	**63**	28	17	**46**	**62**	-	**52**	10	25	23	41	**80**	**44**	13	16	21	21
95	**60**	**130**	27	28	21	**63**	-	**72**	18	31	22	21	15	41	26	29	20	24
96	**2125**	**1100**	**180**	**510**	**1100**	**2000**	**1550**	**850**	**160**	**520**	**150**	**1600**	-	**220**	**240**	**450**	**180**	**2100**
97	**1300**	**1000**	**330**	**1100**	**700**	**1500**	-	**320**	**190**	**1200**	**550**	**1200**	**190**	**310**	**170**	**690**	**500**	**2200**
98	**355**	**330**	**280**	**93**	**150**	**220**	13	**83**	**140**	**82**	**61**	**68**	-	**65**	**140**	**130**	**58**	**44**
99	**1250**	**170**	**360**	**150**	**750**	**490**	3	**44**	**53**	**64**	43	**180**	-	36	**48**	**44**	42	**130**
100	**700**	**150**	**57**	34	**110**	**290**	-	24	38	23	**45**	30	23	33	34	38	**45**	20
101	**95**	**77**	**69**	**110**	**140**	**340**	-	**79**	43	**49**	24	**70**	**53**	**55**	**44**	**47**	32	33
102	**100**	**180**	**44**	**83**	**86**	**160**	-	**120**	**110**	**44**	**46**	**79**	30	**64**	**45**	37	**56**	**58**
103	20	**44**	**55**	**76**	**51**	**76**	-	39	**50**	**49**	43	**60**	**45**	35	**50**	**44**	40	**57**
104	40	**60**	**50**	42	42	**55**	-	**59**	**46**	38	27	39	35	**50**	41	38	27	**35**
105	30	43	**72**	33	40	**48**	-	**46**	**70**	35	30	**50**	**60**	**50**	**71**	33	29	**49**
106	-	-	**450**	**610**	**1200**	**720**	-	-	**210**	**120**	**190**	**230**	-	-	**83**	**120**	**74**	**120**
107	**55**	**530**	**580**	**52**	-	**1600**	-	**130**	**330**	37	-	**640**	**45**	**170**	**270**	**97**	-	**290**
108	**275**	**520**	**100**	**94**	**79**	**300**	-	**900**	**92**	**49**	27	**350**	**98**	**1200**	**88**	**45**	23	**250**
109	**105**	**430**	**300**	**190**	**200**	**630**	-	**100**	**190**	**110**	**130**	**49**	**120**	**130**	**130**	**75**	**84**	**47**
110	**125**	**580**	**77**	**360**	**58**	-	-	**60**	**91**	**280**	28	-	**53**	**64**	**520**	**290**	25	-
111	**133**	**260**	**79**	**200**	28	**440**	-	**150**	**130**	**150**	18	**200**	**50**	**120**	**61**	**110**	16	**170**
112	**50**	**140**	**130**	38	19	**260**	-	**67**	28	33	21	**120**	30	**44**	33	25	24	**59**
113	43	**72**	15	25	**71**	**83**	-	40	14	24	**69**	**67**	**48**	32	18	33	**58**	**53**
114	25	35	40	35	**79**	-	-	30	25	30	26	-	28	31	22	37	29	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 43 ug/g Ni. Values in bold and underlined exceed the Table A Soil Clean up Guideline of 150 ug/g Ni.

Table 9: Selenium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm							5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	-	**4.7**	**2.7**	**2.1**	**4.7**	-	-	**2.8**	1.5	0.41	**6.6**	-	-	**2.9**	0.7	0.66	**6.6**	-
23	-	-	1.9	**2.3**	**2**	-	-	1.2	1.8	**2.5**	**4.1**	-	-	1.4	0.9	1.3	**4.1**	-
24	-	1	0.73	<0.03	**3.7**	-	-	0.43	0.57	0.12	**7.9**	-	-	0.39	<0.3	0.08	**4.8**	-
25	-	0.34	1.1	0.3	0.97	-	-	0.32	0.53	0.22	0.71	-	-	0.29	0.33	0.12	0.36	-
26	-	0.56	0.83	0.64	0.76	-	-	0.7	<0.3	0.3	0.59	-	-	0.52	<0.3	0.16	0.41	-
27	-	1.5	0.37	**4.2**	0.98	1.3	-	0.5	0.33	**2**	0.74	0.6	-	0.57	0.33	1.3	0.52	0.5
28	-	**2.3**	0.77	-	0.86	-	-	0.89	0.33	-	0.36	-	-	0.5	0.4	-	0.78	-
29	-	-	**2.1**	**3.3**	0.28	1.6	-	**2.6**	1.2	**2.5**	<0.2	1.5	-	1.4	0.73	**2.1**	-	1.3
30	-	1.6	0.9	0.23	0.22	1.4	-	0.59	0.8	0.08	<0.2	1.6	-	0.45	0.5	0.04	<0.2	**2.3**
31	-	0.87	1	0.8	**3.6**	0.75	-	0.79	0.8	1.1	1.5	0.55	-	0.63	0.63	1	1.1	0.45
32	-	1.4	0.53	0.86	**2.8**	-	-	0.64	<0.3	0.45	0.47	-	-	0.64	0.33	0.45	0.62	-
33	-	0.81	0.5	0.73	1.1	**2.3**	-	0.54	<0.3	0.65	0.44	0.8	-	0.52	<0.3	0.44	0.78	0.65
34	-	1.4	0.83	1.2	0.91	1.2	-	0.77	<0.3	0.79	0.22	0.4	-	0.62	<0.3	0.47	0.34	<0.2
35	-	0.61	0.4	0.36	1	<0.2	-	0.34	<0.3	0.27	0.32	<0.2	-	0.28	<0.3	0.27	0.41	<0.2
36	-	**3**	**3.6**	**3.4**	**3.2**	-	-	**2.8**	**3.3**	**3.6**	1.9	-	-	**2.1**	**4.3**	**2.5**	0.9	-
37	-	1.3	0.7	0.1	0.57	-	-	1.3	0.33	0.07	0.32	-	-	1.2	0.33	0.06	0.22	-
38	-	0.75	0.9	0.16	0.79	-	-	0.35	0.57	0.11	0.92	-	-	0.24	0.5	0.17	0.73	-
39	-	0.36	0.87	0.87	1.2	0.7	-	0.21	<0.3	0.24	0.27	0.25	-	0.16	<0.3	0.13	0.47	<0.2
40	-	0.34	0.77	0.26	0.27	-	-	0.23	<0.3	0.13	<0.2	-	-	0.16	<0.3	0.06	0.28	-
41	-	0.88	0.3	0.39	<0.2	-	-	0.54	<0.3	0.52	<0.2	-	-	0.61	<0.3	0.48	<0.2	-
42	-	0.19	0.63	0.4	0.68	-	-	0.14	<0.3	0.25	0.4	-	-	0.16	0.5	0.26	0.54	-
43	-	0.38	1.2	1.5	1.1	1.5	-	0.22	0.33	0.71	0.49	0.5	-	0.25	<0.3	0.44	0.28	0.25
44	-	**3.1**	1.3	0.27	**2.2**	**3.2**	-	**2.2**	0.33	0.44	1.4	1.9	-	1.4	0.33	0.52	0.6	1.3
45	-	0.6	<0.3	0.16	**2.2**	-	-	1	0.33	0.09	1.3	-	-	0.67	0.53	0.1	1.1	-
46	-	1.5	1.4	0.32	0.89	0.55	-	0.4	0.37	0.22	0.7	0.4	-	0.18	<0.3	0.17	0.94	0.4
47	-	**3**	1.2	0.64	-	-	-	0.21	0.4	0.59	-	-	-	0.19	0.5	0.43	-	-
48	-	1.3	0.33	0.3	**4.2**	**2.3**	-	0.82	<0.3	0.24	**3.9**	**2.5**	-	1.1	<0.3	0.06	**4.4**	**2.4**
49	-	0.54	1.1	0.68	1.2	1.4	-	0.34	0.63	0.28	0.25	**2.7**	-	0.26	0.37	0.25	0.23	**4.1**
50	-	1.2	**3.7**	0.25	0.5	0.65	-	**2.3**	**3.3**	0.21	<0.2	0.35	-	**2.7**	1.2	0.12	<0.2	0.4
51	-	0.93	0.37	-	-	-	-	0.31	<0.3	-	-	-	-	0.3	<0.3	-	-	-
52	-	**4.9**	1.9	0.23	0.58	<0.2	-	**4**	1.8	0.26	0.22	<0.2	-	**3.2**	1	0.18	0.21	<0.2
53	-	**3.6**	**3.7**	1.4	1.8	-	-	**3.8**	**2.5**	1.6	**2.2**	-	-	**2.3**	1.4	0.58	**2.1**	-
54	-	0.33	0.77	1.7	-	**3.8**	-	0.23	0.87	0.45	-	**2.2**	-	0.25	0.97	0.28	-	0.95

Table 9: Selenium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm							5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	-	**5.2**	0.7	0.44	0.9	**6.7**	-	1.2	0.37	0.16	0.27	0.65	-	0.7	0.33	0.07	0.29	0.4
56	-	1.3	1.3	0.34	1.4	-	-	0.61	0.37	0.09	0.36	-	-	0.65	<0.3	0.04	0.35	-
57	-	0.53	<0.3	<0.03	1	-	-	0.39	<0.3	0.12	1.1	-	-	0.24	<0.3	0.05	1	-
58	-	1.3	<0.3	0.62	1.7	0.9	-	0.35	<0.3	0.28	0.96	0.5	-	0.32	0.4	0.16	0.4	0.5
59	-	1.6	**2**	0.2	1.7	0.95	-	1.4	1.1	0.26	1.2	0.8	-	1.2	1	0.29	0.66	0.65
60	-	0.84	<0.3	0.21	0.59	1.5	-	0.48	<0.3	0.31	0.99	0.8	-	0.43	<0.3	0.21	-	0.75
61	-	1.6	0.4	0.58	1.8	0.6	-	0.56	<0.3	0.33	-	0.5	-	0.44	<0.3	0.18	-	0.4
62	-	0.38	1.9	0.1	0.97	0.55	-	0.29	0.37	0.12	**2.2**	0.35	-	0.16	<0.3	0.04	**2.4**	0.25
63	-	0.84	1.1	0.53	1	**2.3**	-	1.1	1	0.19	1.9	0.85	-	0.93	1.2	0.36	1.8	0.7
64	-	1.5	1.1	1.2	1.7	**2.3**	-	0.3	0.33	1.1	0.78	1.5	-	0.35	<0.3	0.58	0.72	<0.2
65	-	**7.1**	1.2	**2.6**	1.2	**2.5**	-	**2.2**	<0.3	0.28	0.73	0.45	-	0.57	<0.3	0.22	0.48	0.5
66	-	**4.3**	1.4	0.21	0.8	-	-	0.74	<0.3	0.29	0.76	-	-	0.4	<0.3	0.32	0.61	-
67	-	1.1	<0.3	0.32	0.64	0.3	-	0.37	<0.3	0.23	0.61	0.3	-	0.51	<0.3	0.22	-	0.25
68	-	0.41	0.4	0.44	-	0.45	-	0.2	<0.3	0.42	-	<0.2	-	0.37	<0.3	0.4	-	<0.2
69	-	0.45	0.43	0.4	1.2	0.3	-	0.36	<0.3	0.13	0.96	0.3	-	0.38	0.33	0.1	0.77	0.25
70	-	0.6	<0.3	0.21	0.37	0.5	-	0.56	<0.3	0.16	0.58	0.55	-	0.39	<0.3	0.17	0.66	0.7
71	-	0.43	<0.3	0.3	0.2	-	-	0.33	<0.3	0.27	0.2	-	-	0.26	<0.3	0.26	<0.2	-
72	-	**2.1**	**6.5**	1	0.86	**8.7**	-	0.46	**7.2**	0.16	0.91	**6.9**	-	0.45	**7.6**	0.15	**2.1**	**3.9**
73	-	0.62	**2.9**	0.83	-	1.5	-	0.29	0.5	0.33	-	0.85	-	0.13	0.6	0.36	-	0.9
74	-	**3.1**	**3.5**	**2.7**	**4.1**	**2.8**	-	0.67	0.33	0.71	0.61	0.65	-	0.32	<0.3	0.51	0.6	0.4
75	-	**2.8**	**2.8**	**3.8**	**5.6**	**3.6**	-	**2.3**	1.4	**2.9**	1.4	0.45	-	**4.2**	1	1.9	0.59	<0.2
76	-	1.8	1.3	0.24	-	-	-	0.54	0.43	0.04	-	-	-	0.39	0.6	0.05	-	-
77	-	1.2	1.4	0.72	1.2	0.2	-	0.48	0.33	0.31	0.35	0.4	-	0.31	<0.3	0.21	0.21	0.4
78	-	**2.9**	0.93	0.56	-	1.7	-	0.49	<0.3	0.13	-	0.4	-	0.39	<0.3	0.19	-	0.35
79	-	**2.2**	1.8	**2.5**	-	-	-	0.77	<0.3	0.23	-	-	-	0.21	<0.3	0.3	-	-
80	-	**5.3**	**2.3**	**2.8**	**2.8**	**4.2**	-	**3.2**	1.4	**2.2**	**3**	**4**	-	**6.6**	1.5	**2.9**	**2.8**	**4.4**
81	-	1.5	0.83	0.31	0.98	1.3	-	1.9	0.73	0.03	0.99	1.6	-	1.6	0.53	0.21	0.44	1.4
82	-	**3.3**	**3.2**	0.3	0.68	**2.8**	-	1.4	**3.4**	0.12	0.38	0.8	-	0.98	**2.3**	0.12	<0.2	0.85
83	-	-	0.97	-	0.56	-	-	-	0.33	-	0.24	-	-	-	0.37	-	0.25	-
84	-	**3**	**3.5**	-	-	-	-	0.95	**2.6**	-	-	-	-	0.61	**2.9**	-	-	-
85	-	**5.4**	1.3	1.2	1.7	-	-	**2.6**	0.57	0.48	1.8	-	-	1.7	0.47	0.39	1.9	-
86	-	0.28	<0.3	0.56	0.6	-	-	0.27	<0.3	0.32	0.25	-	-	0.23	<0.3	0.31	-	-
87	-	-	**6.7**	**5.7**	-	**8.3**	-	-	**3.3**	**3.9**	-	**5.8**	-	-	**2.1**	**5.6**	-	**2.5**

Table 9: Selenium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm							5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
88	-	**3.3**	**2.6**	0.72	-	**7.8**	-	**3.2**	**3.3**	0.22	-	**4.4**	-	**2.8**	**2.9**	0.19	-	**3.2**
89	-	-	<0.3	-	-	**4.4**	-	**4.7**	0.4	-	-	**2.5**	-	1.5	0.37	-	-	**2.3**
90	-	**2.9**	0.5	-	-	**2.3**	-	**3.1**	0.43	-	-	0.95	-	1.5	0.53	-	-	0.45
91	-	**4.1**	**4**	-	-	**5.7**	-	1 2	**5**	-	-	1.7	-	0.85	**7.5**	-	-	1.1
92	-	**4.4**	1	-	**2.6**	-	-	1.4	0.4	-	1.6	-	-	0.67	0.4	-	0.83	-
93	-	0.99	<0.3	1	0.79	1.7	-	0.81	<0.3	0.43	0.73	0.7	-	0.28	<0.3	0.26	0.74	0.55
94	-	0.91	0.33	0.26	0.63	1	-	0.66	<0.3	0.38	0.37	0.75	-	0.5	<0.3	0.25	0.32	0.35
95	-	1.8	0.5	0.44	<0.2	1.4	-	1.2	0.43	0.42	<0.2	0.65	-	0.91	0.47	0.34	<0.2	0.5
96	-	-	1.5	**33**	**12**	**11**	-	**2.3**	0.73	**29**	0.95	**14**	-	0.95	1.8	**32**	**2.7**	**12**
97	-	-	**2.2**	**7.6**	**7.8**	**9.2**	-	**4.4**	1.5	**5.1**	**6.9**	**7.3**	-	**2.8**	1.3	**3.9**	**8**	**16**
98	-	**5.8**	**2.6**	0.88	1.9	**2.8**	-	1.3	0.97	0.69	0.66	0.9	-	0.69	0.97	0.89	0.54	0.5
99	-	**4.1**	**5.1**	1.2	**9.5**	**4.5**	-	0.75	0.57	0.3	0.83	1.7	-	0.45	0.33	0.15	0.86	0.65
100	-	1.7	<0.3	0.23	1.2	**2.9**	-	0.42	<0.3	0.08	0.74	0.35	-	0.45	<0.3	0.18	0.73	<0.2
101	-	0.79	0.7	1	1.1	**3.8**	-	0.79	<0.3	0.39	0.9	0.95	-	0.39	<0.3	0.26	0.75	0.6
102	-	**2.4**	0.37	0.68	0.96	1.3	-	**2**	0.63	0.33	1.1	0.7	-	0.74	<0.3	0.27	1.1	0.45
103	-	0.46	0.4	0.7	1.4	0.7	-	0.39	0.4	0.43	1.3	0.55	-	0.25	0.4	0.41	1.5	0.45
104	-	0.51	<0.3	0.34	0.97	0.5	-	0.66	0.33	0.36	0.55	0.3	-	0.44	0.4	0.32	0.96	0.25
105	-	0.45	<0.3	0.26	0.92	0.45	-	0.49	0.4	0.28	0.68	0.45	-	0.55	<0.3	0.2	0.78	0.45
106	-	-	**3.6**	**3.8**	**9**	**4.2**	-	-	1.1	0.3	1.5	1.8	-	-	0.33	0.32	0.66	1.2
107	-	-	**5.1**	0.17	-	**8.3**	-	0.98	**2.3**	0.1	-	**4.7**	-	1.3	1.8	0.26	-	**2.4**
108	-	-	0.93	0.79	0.47	1.9	-	**7.5**	0.9	0.27	0.21	1.9	-	**9.6**	0.73	0.14	<0.2	1.8
109	-	**6.8**	**2.2**	0.92	1.1	**4.4**	-	0.6	0.47	0.45	0.59	0.3	-	0.43	<0.3	0.21	0.42	0.3
110	-	**3.1**	1.1	**3.6**	0.44	-	-	1	1.9	**3.3**	<0.2	-	-	0.71	**5.2**	**3.5**	<0.2	-
111	-	**2.5**	0.47	1.5	<0.2	**2.7**	-	0.9	0.77	0.83	<0.2	0.9	-	1.1	0.33	1.2	<0.2	0.8
112	-	**2.4**	0.93	0.4	<0.2	1.6	-	1.3	<0.3	0.26	<0.2	0.85	-	0.86	<0.3	0.15	<0.2	0.45
113	-	1.3	<0.3	0.06	0.28	0.5	-	1.1	<0.3	0.08	0.33	0.45	-	1.1	<0.3	0.09	0.34	0.35
114	-	0.38	0.4	0.41	0.87	-	-	0.34	<0.3	0.4	0.35	-	-	0.3	<0.3	0.43	0.49	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 1.9 ug/g Se. Values in bold and underlined exceed the Table A Soil Clean up Guideline of 10 ug/g Se.

Table 10: Sulphur Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**0.22**	**0.23**	**0.14**	0.04	**0.1**	-	-	**0.12**	0.05	0.03	**0.1**	-	0.07	**0.09**	0.06	0.03	0.07	-
23	**0.22**	**0.24**	**0.11**	0.06	0.05	-	-	0.07	**0.08**	0.05	**0.08**	-	0.07	**0.08**	0.05	0.05	0.07	-
24	**0.18**	0.04	0.03	<0.01	0.05	-	-	0.06	0.04	0.02	0.07	-	0.04	0.06	0.05	0.02	0.05	-
25	0.01	0.03	0.04	0.03	0.02	-	-	0.05	0.03	0.04	0.02	-	0.07	0.05	0.02	0.03	0.03	-
26	0.03	0.05	0.03	0.02	0.02	-	0.06	0.05	0.02	0.02	0.02	-	-	0.07	0.02	<0.01	0.02	-
27	0.04	0.03	0.04	0.05	0.02	0.02	-	0.04	0.07	0.05	0.03	0.03	0.03	0.07	0.07	0.05	0.03	0.04
28	0.02	0.05	0.04	-	0.02	-	0.02	0.03	0.03	-	0.01	-	-	0.03	0.06	-	0.02	-
29	**0.28**	**0.2**	**0.09**	0.07	0.01	0.02	-	**0.12**	**0.09**	0.07	-	0.03	-	**0.09**	**0.08**	0.06	-	0.03
30	**0.16**	**0.13**	0.05	0.03	0.01	0.04	-	0.05	**0.08**	0.02	-	0.04	**0.08**	0.04	0.05	<0.01	-	0.05
31	0.04	0.05	0.06	0.03	0.05	0.03	-	0.05	0.04	0.04	0.03	0.05	0.05	0.06	0.03	0.04	0.04	0.05
32	0.05	0.03	0.03	0.04	0.02	-	-	0.07	0.05	0.03	0.01	-	0.04	0.07	0.04	0.02	0.02	-
33	0.04	0.03	0.03	0.02	0.01	0.04	-	0.06	0.04	0.03	0.01	0.03	0.04	0.06	0.03	0.03	0.01	0.03
34	0.02	0.05	0.03	0.03	0.01	0.02	-	0.06	0.02	0.03	0.02	0.01	**0.09**	**0.08**	0.03	0.04	0.01	0.01
35	0.03	0.02	0.02	<0.01	0.01	0.01	-	0.02	0.02	<0.01	0.01	-	0.01	0.02	0.02	<0.01	0.02	0.01
36	0.06	**0.2**	**0.27**	**0.09**	0.07	-	-	**0.11**	**0.15**	0.07	0.03	-	0.04	**0.08**	**0.13**	0.03	0.01	-
37	0.06	0.07	0.02	<0.01	0.01	-	-	0.04	0.03	<0.01	0.01	-	0.06	0.04	0.05	<0.01	0.02	-
38	0.06	0.03	0.03	<0.01	0.01	-	-	0.04	0.02	<0.01	0.01	-	0.06	0.04	0.03	<0.01	0.01	-
39	0.06	0.02	0.03	0.03	0.01	0.01	-	0.01	0.03	0.03	0.01	0.02	0.03	0.02	0.04	0.03	0.03	0.02
40	0.04	0.04	0.03	0.02	0.01	-	-	0.04	0.03	0.03	0.01	-	0.03	0.03	0.02	0.02	0.01	-
41	0.06	0.02	0.02	0.02	-	-	-	0.02	0.03	<0.01	-	-	0.03	0.03	0.03	<0.01	-	-
42	0.04	0.01	0.02	<0.01	0.02	-	-	0.01	0.02	<0.01	0.02	-	0.02	0.01	0.02	<0.01	0.03	-
43	0.03	0.02	0.05	0.03	0.02	0.03	-	0.02	0.04	0.04	0.01	0.01	0.02	0.02	0.04	0.03	0.01	0.01
44	**0.11**	**0.17**	**0.11**	0.02	0.07	**0.15**	-	**0.13**	0.02	0.02	0.03	0.06	0.03	0.07	0.02	0.02	0.02	0.04
45	**0.13**	0.06	0.02	0.03	0.07	-	-	0.07	0.03	0.02	0.04	-	**0.09**	0.03	0.03	<0.01	0.03	-
46	**0.39**	0.06	0.05	0.02	0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.02	-	0.03	0.02	0.02	0.03	0.02
47	-	0.04	0.04	0.03	-	-	-	0.02	0.04	0.02	-	-	-	0.02	0.03	0.02	-	-
48	**0.21**	0.05	0.02	0.03	**0.15**	0.04	0.07	0.04	0.02	0.02	**0.11**	0.04	-	0.04	0.02	<0.01	**0.11**	0.04
49	**0.16**	0.03	0.05	0.02	0.03	0.03	0.07	0.02	0.03	0.02	0.01	0.06	-	0.02	0.03	<0.01	0.01	**0.1**
50	**0.09**	0.03	0.08	0.04	0.03	0.03	0.03	0.06	0.05	0.02	0.02	0.02	-	0.06	0.03	0.02	0.02	0.03
51	**0.12**	0.03	0.03	-	-	-	0.03	0.02	0.03	-	-	-	-	0.03	0.03	-	-	-
52	**0.18**	**0.15**	0.06	0.02	0.04	0.01	-	**0.12**	0.05	<0.01	0.01	0.01	**0.11**	**0.1**	**0.09**	<0.01	0.01	0.01
53	**0.33**	**0.13**	**0.11**	0.04	0.05	-	-	**0.13**	0.07	0.03	0.04	-	-	**0.1**	0.04	<0.01	0.06	-
54	0.06	0.02	0.04	0.07	-	**0.09**	-	0.02	0.05	0.02	-	0.06	0.05	0.03	0.06	<0.01	-	0.02

Table 10: Sulphur Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
55	**0.1**	**0.18**	0.07	0.03	0.04	**0.1**	-	0.06	0.05	0.02	0.02	0.01	**0.09**	0.05	0.03	<0.01	0.02	0.01
56	**0.09**	0.05	0.06	0.02	0.04	-	-	0.04	**0.09**	<0.01	0.01	-	0.06	0.04	0.04	<0.01	0.01	-
57	**0.1**	0.02	0.02	<0.01	0.02	-	-	0.02	0.02	<0.01	0.01	-	**0.8**	0.02	0.04	<0.01	0.01	-
58	0.04	**0.08**	0.02	0.03	0.04	0.04	-	0.04	0.02	<0.01	0.02	0.02	0.01	0.02	0.04	<0.01	0.01	0.02
59	**0.14**	**0.16**	-	<0.01	0.05	0.07	-	0.12	-	<0.01	0.05	0.05	0.04	**0.13**	0.06	0.02	0.04	0.04
60	**0.08**	0.04	0.04	<0.01	0.03	0.06	-	0.03	0.02	<0.01	0.02	0.03	0.02	0.03	0.02	<0.01	-	0.03
61	0.04	**0.1**	0.05	0.03	0.03	0.04	-	0.04	0.03	<0.01	-	0.02	0.02	0.03	0.02	<0.01	-	0.02
62	**0.18**	**0.08**	0.06	<0.01	0.03	0.04	-	0.06	0.02	<0.01	0.01	0.04	0.04	0.04	0.02	<0.01	0.01	0.03
63	0.05	0.04	0.03	0.02	0.02	0.05	-	0.04	0.03	<0.01	0.01	0.02	0.03	0.04	0.03	<0.01	-	0.02
64	0.07	0.05	0.05	0.05	0.07	0.04	-	0.03	0.02	0.06	0.03	0.03	0.03	0.04	0.02	0.04	0.02	0.01
65	0.04	**0.43**	0.04	0.05	0.03	0.03	-	**0.16**	0.02	<0.01	0.02	0.01	0.03	0.05	0.02	<0.01	0.01	0.01
66	0.08	**0.11**	0.05	<0.01	0.01	-	-	0.02	0.03	<0.01	0.01	-	0.02	0.02	0.02	<0.01	-	-
67	0.02	0.05	0.03	0.02	0.02	0.02	-	0.02	0.02	0.02	0.02	0.01	0.03	0.03	0.02	0.02	-	0.01
68	0.02	0.02	0.05	0.03	-	0.03	-	0.02	0.02	0.03	-	0.01	0.02	0.04	0.02	0.02	-	0.01
69	0.03	0.05	0.05	0.02	0.03	0.03	-	0.03	0.03	<0.01	0.03	0.01	0.02	0.03	0.02	<0.01	0.02	0.02
70	0.04	0.03	0.02	0.02	0.01	0.02	-	0.04	0.02	<0.01	0.01	0.03	0.01	0.03	0.02	<0.01	0.01	0.04
71	0.02	0.03	0.04	0.02	0.01	-	-	0.02	0.03	<0.01	-	-	0.01	0.02	0.02	<0.01	-	-
72	0.03	0.05	0.07	0.02	0.01	**0.09**	-	0.02	**0.08**	<0.01	-	**0.09**	0.01	0.02	0.07	<0.01	-	**0.12**
73	0.04	0.05	0.04	0.03	-	0.02	-	0.02	0.03	0.02	-	0.01	0.02	0.02	0.02	<0.01	-	0.01
74	**0.1**	0.05	0.05	0.02	0.02	0.02	-	0.03	0.02	<0.01	-	0.01	0.07	0.02	0.02	<0.01	-	0.01
75	**0.14**	**0.11**	**0.13**	**0.16**	0.04	0.05	-	**0.11**	0.07	**0.15**	0.02	0.02	**0.09**	**0.11**	**0.1**	**0.15**	0.01	0.01
76	-	**0.09**	0.05	<0.01	-	-	-	0.03	0.02	<0.01	-	-	-	0.02	0.03	<0.01	-	-
77	0.04	0.04	0.04	0.02	0.01	0.01	-	0.03	0.03	0.02	0.01	0.01	0.02	0.02	0.03	<0.01	0.01	0.01
78	**0.16**	**0.1**	0.04	0.03	-	0.04	-	0.04	0.02	<0.01	-	0.01	0.02	0.03	0.03	<0.01	-	0.01
79	**0.08**	0.06	0.07	0.03	-	-	-	0.02	0.03	0.02	-	-	0.01	0.02	0.02	0.02	-	-
80	**0.25**	**0.08**	0.07	0.07	0.04	0.06	-	0.07	0.07	0.05	0.04	0.06	0.02	**0.12**	0.05	0.07	0.05	**0.08**
81	0.03	0.07	0.04	<0.01	0.01	0.02	-	0.06	0.04	<0.01	0.01	0.03	0.06	0.06	0.04	<0.01	0.01	0.03
82	**0.25**	**0.18**	**0.16**	0.02	0.02	0.05	-	0.06	**0.15**	0.03	0.01	0.02	**0.12**	**0.08**	**0.12**	0.02	0.01	0.02
83	-	-	0.05	0.03	0.02	-	-	-	0.04	<0.01	0.02	-	-	-	0.04	<0.01	0.02	-
84	-	0.07	**0.1**	0.07	-	-	-	0.04	0.08	0.07	-	-	-	0.05	0.07	0.05	-	-
85	**0.11**	**0.09**	0.06	0.03	**0.83**	-	-	0.07	0.03	0.02	**0.28**	-	0.03	0.07	0.04	0.03	**0.14**	-

Table 10: Sulphur Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm						5 to 10 cm						10 to 15 cm					
	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
86	**0.11**	0.02	0.03	0.02	0.02	-	-	0.03	0.02	<0.01	0.01	-	0.02	0.03	0.02	<0.01	-	-
87	**0.2**	**0.18**	**0.16**	**0.08**	0.05	**0.09**	-	-	**0.12**	0.06	0.03	**0.09**	-	-	**0.08**	**0.09**	0.03	0.06
88	**0.09**	**0.16**	**0.08**	0.05	0.07	**0.09**	-	**0.09**	**0.09**	0.03	0.02	0.07	**0.08**	**0.08**	**0.08**	0.03	0.01	**0.08**
89	0.04	**0.09**	0.02	0.05	**0.08**	**0.1**	-	0.05	0.02	0.02	0.05	**0.14**	0.04	0.02	0.04	<0.01	0.05	**0.14**
90	0.07	0.06	0.03	0.03	0.05	0.06	-	0.04	0.02	0.07	0.02	0.02	0.03	0.03	0.02	0.03	0.01	0.01
91	**0.13**	0.04	0.07	0.03	0.05	0.07	-	0.02	**0.08**	0.03	0.01	0.02	0.02	0.02	**0.11**	0.02	0.01	0.02
92	0.02	**0.1**	0.05	<0.01	**0.08**	-	-	0.06	0.03	<0.01	0.05	-	0.02	0.03	0.03	<0.01	0.03	-
93	0.05	0.04	0.03	0.03	0.04	0.04	-	0.04	0.02	0.02	0.04	0.02	0.03	0.02	0.02	<0.01	0.03	0.02
94	**0.08**	0.04	0.02	0.02	0.02	0.02	-	0.04	0.02	0.02	0.01	0.01	0.03	0.03	0.02	<0.01	0.02	0.01
95	**0.09**	**0.08**	0.03	0.03	0.02	0.03	-	0.05	0.03	0.03	0.01	0.02	0.02	0.04	0.05	0.02	0.01	0.03
96	**0.18**	**0.23**	0.03	0.06	0.07	**0.13**	**0.09**	**0.12**	0.03	0.03	0.05	**0.09**	-	0.03	0.04	0.04	0.05	**0.12**
97	**0.41**	**0.29**	**0.26**	**1.7**	**0.8**	**0.23**	-	**0.18**	**0.13**	**1.2**	**0.71**	**0.18**	0.06	**0.17**	**0.16**	**0.5**	**0.79**	**0.21**
98	**0.12**	**0.08**	**0.08**	0.06	0.05	0.06	0.01	0.03	0.04	0.06	0.04	0.03	-	0.02	0.03	0.07	0.03	0.02
99	**0.28**	0.07	0.07	0.04	**0.09**	0.06	0.01	**0.08**	0.04	<0.01	0.01	0.03	-	0.06	0.04	<0.01	0.01	0.02
100	**0.13**	0.07	0.03	<0.01	0.02	0.03	-	0.03	0.02	<0.01	0.01	0.01	0.01	0.04	0.02	<0.01	0.01	-
101	0.04	0.03	0.03	0.03	0.02	**0.1**	-	0.02	0.03	0.02	0.03	0.03	0.02	0.02	0.03	<0.01	0.03	0.02
102	0.07	**0.08**	0.02	0.03	0.03	0.06	-	0.04	0.05	<0.01	0.01	0.02	0.02	0.03	0.02	<0.01	0.01	0.01
103	0.04	0.03	0.04	0.04	0.03	0.04	-	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03	<0.01	0.02	0.03
104	0.03	0.04	0.05	0.03	0.03	0.03	-	0.03	0.04	0.02	0.01	0.02	0.02	0.03	0.04	0.02	0.01	0.01
105	0.02	0.02	0.05	0.02	0.03	0.03	-	0.02	0.05	0.02	0.01	0.02	0.02	0.02	0.05	0.02	0.01	0.02
106	-	-	0.06	0.04	0.07	0.04	-	-	0.03	<0.01	0.01	0.02	-	-	0.02	<0.01	0.01	0.02
107	0.03	**0.09**	0.07	<0.01	-	**0.09**	-	0.02	0.04	<0.01	-	**0.08**	0.01	0.03	0.03	<0.01	-	0.12
108	0.07	0.05	0.05	0.04	0.01	0.02	-	0.07	0.04	0.02	0.01	0.01	0.01	**0.15**	0.04	0.03	0.01	0.01
109	0.05	0.06	0.04	0.02	0.01	0.04	-	0.03	0.02	0.02	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.01
110	0.04	0.06	0.07	**0.09**	0.01	-	-	0.04	0.07	0.11	0.01	-	0.03	0.03	**0.11**	0.06	0.01	-
111	0.07	0.06	0.03	0.03	-	0.03	-	0.03	0.04	0.05	-	0.01	0.01	0.03	0.03	0.04	-	0.01
112	0.06	0.06	0.03	0.06	-	0.03	-	0.06	0.03	<0.01	0.01	0.01	0.06	0.06	0.03	<0.01	0.01	0.01
113	0.03	**0.16**	0.02	<0.01	0.03	0.02	-	**0.12**	0.02	<0.01	0.02	0.02	0.04	**0.1**	0.02	<0.01	0.02	0.02
114	0.01	0.03	0.07	0.02	0.05	-	-	0.02	0.03	<0.01	0.02	-	0.01	0.02	0.02	<0.01	0.02	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
No Soil Clean-up Guidelines for sulphur in soil have been established, therefore concentrations in bold exceed the OTR_{98} Guideline of 0.079%.

Table 11: Zinc Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

	0 to 5 cm						5 to 10 cm						10 to 15 cm					
Station	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	65	43	31	23	38	-	-	40	26	36	32	-	43	40	42	42	35	-
23	50	50	44	43	37	-	-	32	44	45	66	-	88	52	45	52	65	-
24	45	5	13	13	35	-	-	7	15	16	41	-	25	13	16	14	34	-
25	33	8	17	13	10	-	-	25	17	21	13	-	33	21	20	20	19	-
26	43	12	13	25	10	-	33	23	12	23	11	-	-	7	12	22	14	-
27	38	11	36	34	33	30	-	12	55	33	46	47	30	14	54	40	48	62
28	38	25	29	-	29	-	33	13	29	-	31	-	-	18	39	-	59	-
29	35	47	30	37	18	28	-	33	45	40	15	25	-	27	48	44	-	28
30	20	20	18	19	16	47	-	8	24	19	14	36	20	8	23	13	14	36
31	80	13	20	46	26	15	-	15	17	22	22	21	43	25	16	24	27	24
32	18	5	14	28	20	-	-	34	28	32	17	-	35	39	33	35	25	-
33	33	23	23	27	58	44	-	58	35	28	29	46	65	57	34	35	25	56
34	18	36	19	40	30	29	-	50	17	47	48	20	50	70	24	52	32	19
35	20	22	23	21	16	22	-	39	32	21	14	21	25	38	32	19	37	21
36	11	48	38	46	43	-	-	46	39	59	28	-	14	36	32	36	18	-
37	-	27	15	8	17	-	-	29	20	11	14	-	17	23	25	10	15	-
38	15	25	15	13	16	-	-	35	19	11	16	-	18	33	24	12	14	-
39	11	34	15	18	10	14	-	32	15	15	7	20	9	28	14	14	15	26
40	14	14	24	16	16	-	-	28	28	15	15	-	15	12	25	16	14	-
41	14	24	12	23	14	-	-	20	14	18	11	-	14	15	16	18	10	-
42	6	22	65	25	43	-	-	13	28	25	37	-	9	13	27	31	47	-
43	13	10	24	17	32	29	-	10	27	21	18	25	10	10	28	21	19	25
44	15	23	35	5	43	55	-	26	19	7	23	37	20	20	18	11	18	27
45	28	8	19	12	36	-	-	13	21	13	25	-	45	10	26	11	25	-
46	**173**	7	11	16	17	12	35	3	10	17	17	10	-	3	13	18	19	10
47	-	27	14	18	-	-	-	25	23	16	-	-	-	18	18	15	-	-
48	50	25	17	28	35	41	70	18	14	27	22	29	-	18	13	23	28	25
49	138	36	42	35	15	28	50	41	42	21	10	28	-	38	39	16	9	30
50	38	28	44	17	10	12	78	22	110	19	13	12	-	35	120	19	11	12
51	155	3	16	-	-	-	50	3	14	-	-	-	-	3	16	-	-	-
52	30	11	38	36	29	24	-	15	47	25	18	24	28	24	60	38	25	23
53	45	31	36	41	40	-	-	26	45	40	41	-	-	30	56	41	45	-

Table 11: Zinc Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

	0 to 5 cm						5 to 10 cm						10 to 15 cm					
Station	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
54	15	4	28	86	-	43	-	3	27	21	-	34	21	9	28	9	-	27
55	28	23	19	30	43	42	-	18	21	30	37	33	31	14	19	31	36	33
56	32	46	27	26	29	-	-	36	19	26	17	-	28	33	23	29	17	-
57	43	7	14	21	24	-	-	7	16	21	24	-	24	6	20	22	22	-
58	26	22	32	62	67	44	-	34	35	39	59	41	24	27	39	37	46	40
59	67	50	130	26	60	59	-	38	140	43	71	56	82	35	130	43	55	61
60	115	62	58	27	47	51	-	78	56	30	45	47	**208**	82	60	33	-	60
61	145	75	92	110	66	100	-	76	71	71	-	83	123	62	58	51	-	90
62	110	28	45	23	41	21	-	28	44	25	46	23	78	27	41	19	41	20
63	**165**	33	30	45	49	63	-	28	33	63	55	61	93	24	26	38	57	59
64	70	28	46	21	43	48	-	25	40	22	41	39	148	35	36	36	41	33
65	113	140	47	37	53	49	-	88	46	41	55	36	133	58	44	36	46	37
66	153	75	50	14	46	-	-	64	48	26	39	-	**233**	54	46	40	37	-
67	75	28	25	23	33	29	-	26	23	16	36	26	158	39	23	11	-	22
68	120	17	22	83	-	26	-	23	17	76	-	17	55	39	19	54	-	17
69	140	19	47	110	74	70	-	21	38	99	66	67	38	35	32	87	66	67
70	100	79	36	48	58	45	-	77	39	39	58	68	103	58	43	37	55	77
71	75	89	32	43	21	-	-	34	31	38	19	-	80	28	29	39	20	-
72	18	14	45	35	52	85	-	14	45	36	46	68	11	13	47	33	44	65
73	22	24	28	44	-	48	-	21	35	43	-	34	21	21	28	39	-	33
74	41	40	80	50	75	72	-	38	61	47	69	82	46	28	56	50	76	50
75	-	30	32	57	58	66	-	30	26	31	44	59	43	28	25	33	45	61
76	-	25	130	36	-	-	-	8	68	31	-	-	-	9.3	73	30	-	-
77	28	13	31	27	40	31	-	9.7	29	33	41	30	25	7.7	31	40	27	28
78	55	52	74	40	-	79	-	63	77	30	-	89	53	58	73	27	-	93
79	45	54	44	24	-	-	-	58	47	26	-	-	33	47	35	25	-	-
80	-	57	52	41	37	54	-	50	56	41	35	52	-	56	60	41	35	55
81	55	50	33	41	33	46	-	43	42	33	33	37	56	25	47	38	31	36
82	45	56	45	15	23	49	-	31	52	12	13	33	27	51	65	16	14	29
83	-	-	39	33	24	-	-	-	37	40	20	-	-	-	37	42	20	-
84	-	40	42	38	-	-	-	34	36	40	-	-	-	29	33	35	-	-
85	50	67	82	62	73	-	-	78	48	31	79	-	46	68	43	25	76	-
86	53	18	33	36	29	-	-	25	34	36	38	-	34	27	36	35	-	-

Table 11: Zinc Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

	0 to 5 cm						5 to 10 cm						10 to 15 cm					
Station	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
87	63	43	50	**220**	48	69	-	-	46	**270**	41	81	-	-	45	**220**	43	51
88	28	28	38	26	50	110	-	29	39	15	37	68	30	18	39	12	32	74
89	23	38	38	49	89	63	-	30	34	32	80	58	23	23	35	29	67	63
90	43	18	54	45	55	100	-	10	55	53	42	80	43	13	58	43	35	75
91	65	60	40	98	55	58	-	54	49	92	40	48	78	53	50	70	37	65
92	48	130	61	41	69	-	-	81	54	46	48	-	45	63	46	46	47	-
93	25	53	36	55	47	55	-	51	35	33	49	34	28	39	35	32	43	36
94	45	32	30	25	33	25	-	27	24	28	32	22	23	35	25	22	28	21
95	50	84	43	40	20	38	-	58	47	39	19	41	34	43	45	39	18	54
96	95	48	39	65	43	110	58	55	43	91	31	110	-	37	43	73	31	130
97	53	61	52	110	56	92	-	53	67	110	49	80	75	53	64	79	46	97
98	38	50	50	32	29	37	30	46	50	32	28	31	-	43	48	31	29	29
99	58	44	36	31	53	60	23	59	32	25	33	51	-	60	31	23	29	52
100	60	35	35	25	43	25	-	36	32	24	45	21	65	38	28	25	44	21
101	45	11	24	45	27	140	-	9.3	29	50	57	66	50	9.3	36	40	62	45
102	85	100	66	71	70	93	-	100	69	62	66	86	55	100	76	60	65	79
103	70	53	79	100	76	100	-	47	80	87	77	97	73	39	81	83	76	97
104	50	56	110	93	57	83	-	50	130	87	53	75	63	60	100	87	49	63
105	95	72	70	79	58	110	-	73	73	78	51	110	85	67	67	66	50	110
106	-	-	42	40	56	120	-	-	31	29	35	64	-	-	25	30	28	55
107	82	33	46	36	-	54	-	25	47	38	-	35	42	32	46	71	-	32
108	20	29	40	51	27	40	-	28	43	39	23	44	15	36	46	28	22	46
109	32	48	62	54	51	56	-	45	65	51	47	46	33	53	58	52	46	49
110	25	33	98	34	24	-	-	27	99	28	30	-	38	29	87	30	24	-
111	23	38	37	39	16	58	-	28	41	36	16	57	35	35	36	30	16	57
112	16	92	31	45	13	50	-	94	31	43	14	45	20	80	34	34	15	51
113	50	62	16	35	120	57	-	57	15	20	140	47	69	56	21	29	120	43
114	38	58	48	73	38	-	-	50	48	90	46	-	38	44	47	89	50	-

* Depths sampled in 1971 were 0-2.5 cm rather than 0-5 cm.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 160 ug/g Zn. There are no values that exceed the Table A Soil Clean up Guideline of 600 ug/g Zn.

Table 12: Aluminum and Cadmium Concentrations in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	Aluminum						Cadmium					
	0 to 5 cm		5 to 10 cm		10 to 15 cm		0 to 5 cm		5 to 10 cm		10 to 15 cm	
	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997
22	6300	-	7700	-	8100	-	**2.2**	-	**1.8**	-	0.43	-
23	6200	-	8800	-	11000	-	**1.6**	-	0.96	-	0.95	-
24	8600	-	7400	-	8500	-	**1.8**	-	0.67	-	0.24	-
25	6000	-	7100	-	11000	-	0.68	-	0.23	-	<0.2	-
26	7800	-	9400	-	11000	-	0.73	-	0.22	-	<0.2	-
27	11000	8400	18000	16000	17000	20000	0.32	0.4	0.5	0.25	0.45	0.4
28	4800	-	8400	-	18000	-	0.45	-	0.29	-	0.42	-
29	6000	7700	6100	7800	-	8200	0.36	0.45	0.28	<0.2	-	<0.2
30	7600	14000	7200	13000	7300	12000	<0.2	0.8	0.34	0.4	0.22	0.25
31	6800	6000	14000	13000	19000	16000	0.7	<0.2	0.38	0.25	0.52	0.3
32	4500	-	7400	-	12000	-	0.43	-	0.24	-	0.93	-
33	11000	10000	11000	15000	9400	19000	0.53	0.5	0.45	<0.2	0.93	0.4
34	11000	10000	16000	10000	15000	10000	0.33	0.3	0.66	<0.2	**1.2**	<0.2
35	3800	9900	6100	10000	14000	10000	0.33	<0.2	0.39	<0.2	**1.1**	<0.2
36	9800	-	9900	-	8800	-	**1.1**	-	**1.1**	-	0.99	-
37	8600	-	10000	-	10000	-	0.38	-	0.37	-	0.23	-
38	6200	-	6400	-	6500	-	0.39	-	0.33	-	0.26	-
39	3000	5400	6300	10000	13000	13000	0.28	<0.2	0.23	0.25	0.38	<0.2
40	7500	-	6800	-	7200	-	0.26	-	0.26	-	0.27	-
41	5900	-	5100	-	4900	-	0.23	-	<0.2	-	<0.2	-
42	7300	-	6200	-	5900	-	0.37	-	0.28	-	0.32	-
43	7500	8900	9000	9500	9300	9600	0.38	0.3	0.31	<0.2	0.24	<0.2
44	13000	12000	12000	15000	11000	14000	0.8	**1.1**	0.35	0.4	0.29	<0.2
45	8900	-	9600	-	11000	-	0.89	-	0.27	-	0.48	-
46	6400	7100	6600	7600	6900	7600	0.51	0.25	0.35	<0.2	0.43	<0.2
47	-	-	-	-	-	-	-	-	-	-	-	-
48	7300	8500	6300	8400	8600	8800	0.55	<0.2	0.29	<0.2	<0.2	<0.2
49	6200	10000	5700	11000	6100	9400	0.31	<0.2	0.21	<0.2	<0.2	<0.2
50	5600	6300	6200	6900	7100	7400	0.25	0.25	0.22	<0.2	0.21	<0.2
51	-	-	-	-	-	-	-	-	-	-	-	-
52	15000	13000	8800	12000	9000	12000	0.29	<0.2	<0.2	<0.2	0.21	<0.2
53	16000	-	17000	-	17000	-	0.29	-	0.26	-	0.54	-
54	-	12000	-	13000	-	12000	-	0.45	-	0.6	-	0.3
55	14000	13000	15000	13000	15000	13000	0.39	0.65	0.34	0.3	0.38	0.4
56	9100	-	8800	-	9500	-	0.36	-	0.23	-	0.46	-
57	10000	-	12000	-	10000	-	0.55	-	0.61	-	0.6	-
58	23000	14000	25000	14000	21000	14000	0.88	0.7	1	0.45	0.75	0.45
59	20000	18000	20000	21000	23000	23000	0.56	0.7	0.84	0.5	0.72	0.8
60	13000	9100	20000	11000	-	17000	0.71	0.85	0.89	0.55	-	0.6
61	18000	12000	-	15000	-	18000	1	0.95	-	0.65	-	1
62	23000	11000	**35000**	13000	**36000**	12000	1	<0.2	0.64	<0.2	0.5	<0.2
63	23000	20000	27000	22000	27000	21000	0.83	<0.2	0.6	0.25	0.6	<0.2
64	23000	9700	27000	10000	26000	10000	0.82	0.5	0.56	0.3	0.57	0.25
65	15000	7300	18000	8800	18000	10000	0.48	0.25	0.43	<0.2	0.34	0.3
66	19000	-	18000	-	16000	-	0.49	-	0.38	-	0.24	-
67	14000	12000	14000	11000	-	9600	**1.3**	<0.2	0.86	<0.2	-	<0.2
68	-	7700	-	8400	-	9400	-	0.25	-	<0.2	-	<0.2
69	18000	17000	21000	19000	22000	17000	0.63	0.2	**1.2**	0.25	**1.2**	<0.2
70	25000	11000	23000	21000	27000	25000	0.68	0.35	**1.1**	<0.2	**1.1**	<0.2
71	9300	-	9100	-	9000	-	0.42	-	0.54	-	0.56	-

Table 12: Aluminum and Cadmium Concentrations in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	Aluminum						Cadmium					
	0 to 5 cm		5 to 10 cm		10 to 15 cm		0 to 5 cm		5 to 10 cm		10 to 15 cm	
	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997	1992	1997
72	25000	11000	27000	12000	25000	12000	0.3	0.45	0.36	0.25	0.81	0.4
73	-	11000	-	11000	-	11000	-	0.5	-	0.45	-	0.35
74	9800	11000	13000	14000	12000	16000	1	**1.1**	0.49	0.5	0.57	0.4
75	11000	18000	16000	23000	18000	27000	0.89	**1.1**	0.47	0.5	0.56	0.5
76	-	-	-	-	-	-	-	-	-	-	-	-
77	6700	7300	8100	7600	9000	7600	0.53	0.5	0.55	0.3	0.34	0.3
78	-	16000	-	19000	-	19000	-	0.55	-	0.55	-	0.45
79	-	-	-	-	-	-	-	-	-	-	-	-
80	9200	7900	8900	7500	8200	8200	0.58	0.55	0.65	0.35	0.44	0.55
81	12000	18000	9300	14000	9500	14000	0.64	0.45	0.56	0.35	0.27	0.3
82	6300	13000	6000	12000	7400	10000	0.33	0.55	0.22	0.25	<0.2	0.25
83	12000	-	11000	-	10000	-	0.27	-	0.27	-	0.23	-
84	-	-	-	-	-	-	-	-	-	-	-	-
85	13000	-	16000	-	20000	-	**1.3**	-	**1.3**	-	**1.1**	-
86	8500	-	13000	-	-	-	0.43	-	0.45	-	-	-
87	16000	9900	17000	12000	18000	14000	0.62	0.25	0.46	0.5	0.37	<0.2
88	18000	14000	15000	16000	14000	18000	0.64	0.25	0.48	0.3	0.23	<0.2
89	**39000**	11000	37000	12000	32000	11000	0.87	**1.7**	0.7	0.7	0.54	1
90	14000	14000	14000	14000	14000	16000	0.64	**1.4**	0.48	0.7	0.32	0.55
91	12000	10000	13000	12000	14000	19000	0.83	**1.1**	0.33	0.5	0.24	0.35
92	26000	-	26000	-	25000	-	**1.8**	-	0.79	-	0.44	-
93	8800	9800	9400	11000	11000	11000	0.72	0.7	0.65	0.3	0.67	0.35
94	8700	8100	12000	7500	12000	8100	0.31	0.3	0.24	0.35	0.3	<0.2
95	7100	5900	7600	13000	7500	20000	0.23	0.45	0.26	0.25	0.21	0.4
96	7000	8800	7600	9800	7200	10000	**2.7**	**1.2**	**3.3**	0.7	**3.2**	0.4
97	27000	26000	26000	27000	23000	24000	0.47	<0.2	0.22	0.5	0.94	0.75
98	11000	11000	13000	11000	13000	11000	0.23	0.3	0.21	0.3	0.33	0.25
99	13000	14000	12000	14000	13000	14000	0.43	0.5	0.31	0.55	0.32	0.5
100	15000	8100	15000	9000	16000	9000	<0.2	0.25	0.44	0.25	0.42	<0.2
101	5700	8400	13000	8400	14000	9700	<0.2	**1.3**	0.54	0.45	0.48	0.3
102	12000	21000	18000	22000	27000	23000	**1.1**	0.75	0.61	0.55	0.8	0.25
103	17000	23000	17000	24000	19000	24000	**1.1**	0.55	0.64	0.6	0.68	0.4
104	14000	16000	14000	16000	15000	17000	0.98	0.35	0.55	<0.2	0.54	<0.2
105	18000	25000	20000	25000	20000	28000	0.8	0.4	0.63	0.3	0.66	0.3
106	16000	13000	17000	16000	14000	15000	**1.2**	**1.4**	0.57	0.5	0.38	0.4
107	-	13000	-	12000	-	13000	-	0.35	-	0.35	-	0.4
108	10000	10000	9300	12000	8900	11000	0.29	0.35	0.22	0.35	0.31	0.35
109	15000	14000	14000	14000	18000	15000	0.71	<0.2	0.41	<0.2	0.48	<0.2
110	6900	-	6400	-	6500	-	0.3	-	<0.2	-	0.41	-
111	4900	13000	5000	12000	5100	12000	0.22	0.65	<0.2	0.3	0.36	0.3
112	8400	9700	8400	12000	9300	14000	0.32	0.4	0.38	0.35	0.33	0.25
113	13000	12000	13000	12000	13000	12000	0.87	0.3	0.93	<0.2	0.76	<0.2
114	12000	-	23000	-	23000	-	0.57	-	0.64	-	0.64	-

Values represent duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 1.0 ug/g Cd. No Table F Guideline exists for Aluminum so concentrations shown in bold exceed the OTR_{98} of 30,000 ug/g Al. There are no values that exceed the Table A Soil Clean up Guideline of 12 ug/g Cd.

Table 13: Calcium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
22	960	1500	2900	-	730	1500	1700	-	930	1400	3400	-
23	990	1400	3100	-	770	1300	3900	-	810	1400	1100	-
24	780	1400	1100	-	740	1500	970	-	670	1400	1100	-
25	590	680	600	-	640	1000	680	-	840	1100	1100	-
26	680	810	790	-	630	1000	800	-	520	1300	1700	-
27	880	930	1200	1300	1300	960	1400	1600	1400	1200	1700	1900
28	1200	-	1600	-	1400	-	1300	-	950	-	-	-
29	600	1100	4900	4600	820	1200	2900	2300	760	1300	2000	2000
30	640	1600	2400	13000	790	1300	2200	2300	720	1200	1200	1800
31	900	1500	1100	800	760	930	920	850	800	1000	1000	1200
32	460	1100	630	-	630	1300	670	-	780	1300	1700	-
33	610	1700	2600	1600	980	1300	2600	1400	930	1100	1900	1600
34	830	920	1400	2300	660	1000	1700	2000	920	1300	920	2000
35	600	1500	440	1500	580	1500	550	1500	600	1400	1600	1500
36	2000	1600	2100	-	1300	1800	1800	-	870	1600	1300	-
37	840	32000	1400	-	610	1800	1400	-	690	2000	1300	-
38	570	1300	1500	-	640	1500	1500	-	720	1500	950	-
39	480	750	530	850	500	830	590	950	300	920	2300	1200
40	900	1100	1400	-	1000	1100	1800	-	800	1200	1700	-
41	590	1300	2600	-	510	1200	1900	-	600	960	4400	-
42	1700	4100	4000	-	1300	4300	4900	-	1600	4100	1700	-
43	860	1100	2800	1900	830	1300	1800	2000	1100	1400	1100	2100
44	1400	1500	2100	5200	1100	1700	1400	2700	1400	1900	1500	1600
45	1800	1900	1900	-	1400	2200	1500	-	1200	2400	2100	-
46	600	1300	1900	1300	490	1200	2000	1100	750	1200	-	1200
47	690	1200	-	-	680	1400	-	-	480	1300	1800	-
48	1600	2300	1900	3100	1200	2400	1600	2600	1000	2300	1100	2000
49	3800	2700	1300	6300	2700	1900	1100	2700	3400	1900	1000	2800
50	1200	1100	700	1100	1700	1400	720	1200	2400	1700	-	1300
51	550	-	-	-	400	-	-	-	640	-	2800	-
52	1900	3600	2700	3300	1800	2800	2400	2900	2000	2900	1700	3000
53	1700	1600	1700	-	2100	2000	1800	-	2700	3600	-	-
54	1300	2700	-	2000	1400	2800	-	2000	1300	2700	6800	2200
55	1200	2100	6700	1800	1700	2400	6900	2500	1500	2500	2700	2300
56	960	2000	2900	-	1000	2200	2900	-	910	2100	1800	-
57	2300	2300	2000	-	2400	2400	2200	-	2900	2500	5000	-
58	3200	2800	5900	3500	3200	2600	5700	3100	3300	2500	2800	3100
59	1900	3500	3500	3300	1500	3200	2800	2700	1600	3400	-	2800
60	4400	4200	4000	3000	3800	4100	3400	2300	3800	4000	-	2600
61	4700	4000	6000	5000	3300	4400	-	4200	2900	4500	4800	4600
62	3500	2000	18000	1600	19000	2100	7600	1700	14000	2100	4900	1700
63	1500	3500	3600	3200	1700	3500	3700	3600	1600	3700	3000	3600
64	1600	3600	3200	2400	1200	2900	2700	2400	1300	2800	2900	2100
65	1700	2200	2700	1900	1400	2300	2600	2100	1600	2600	8100	2000
66	1500	1700	6400	-	1100	3100	7100	-	1200	3500	-	-
67	1400	2300	2800	2600	1200	1900	3300	2500	1400	1900	-	2300
68	4100	4400	-	3500	3400	4500	-	3300	3100	3700	4600	3700
69	2900	6100	4400	4600	1700	7200	4700	4200	1400	7300	3600	4000
70	2000	3200	3600	1700	1700	3000	3500	2000	2200	3200	3700	2600
71	1600	3100	3900	-	1500	2600	4100	-	1500	3100	6000	-
72	3700	6300	5100	7100	2800	4700	5900	3400	1800	4900	-	3900
73	1500	1700	-	4600	1100	2000	-	4000	1300	2200	2800	3800
74	2300	2300	2700	3500	800	2000	2800	3200	920	2600	2100	3300

Table 13: Calcium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
75	840	4500	1900	5800	890	6300	1900	2800	920	6800	-	2800
76	2800	2800	-	-	2600	2700	-	-	2500	2600	1200	-
77	1100	900	1700	1300	550	1200	1100	1100	630	950	-	1100
78	2400	2000	-	3300	1800	3300	-	3900	1300	2200	-	4400
79	1400	960	-	-	920	1300	-	-	680	1200	1200	-
80	930	1000	1100	2100	1100	1000	1200	1500	860	1100	3100	1600
81	1200	4100	2900	3600	1200	3200	3000	2900	1700	3800	2800	2900
82	1700	1600	3200	3600	2100	1800	2400	3400	2800	2300	1300	3500
83	2500	3300	1400	-	410	4800	1300	-	660	5300	-	-
84	1400	1900	-	-	1200	2000	-	-	1500	1900	6800	-
85	14000	5800	24000	-	15000	4600	10000	-	11000	4000	-	-
86	8300	8700	3300	-	9100	13000	9400	-	9900	13000	2600	-
87	1400	3400	2900	2600	1200	2900	2100	2900	1000	3200	2600	2200
88	1600	2200	3300	2500	1700	2200	3100	2400	1700	2200	2000	2200
89	2500	2100	1800	6700	1600	2300	2000	7300	1500	2700	2900	7400
90	2500	2100	2700	4100	2600	2400	2900	3900	2700	1900	2600	4300
91	3500	9700	2400	2300	3200	9500	2800	1900	1900	14000	8100	2500
92	990	18000	11000	-	1000	17000	9100	-	2800	10000	6000	-
93	2600	2700	5300	3400	940	2400	5300	3300	1200	2500	2200	2800
94	2100	1500	1700	1700	4300	1700	1700	1600	4000	1600	2400	1400
95	1200	2000	2400	1600	840	2200	2400	1700	870	2000	3800	2200
96	2500	3400	4300	5800	2300	4400	3800	5500	2400	3900	11000	6600
97	8200	6400	14000	10000	7600	6500	12000	8400	6500	3800	1600	8000
98	3200	1600	1600	2500	4100	1700	1700	2100	3800	1700	2200	2400
99	2100	3500	2700	4700	1000	3500	2200	3900	860	3500	2900	3600
100	3500	3000	3000	2300	4100	3100	2500	2200	4400	3100	1400	2400
101	1300	1500	970	1700	1200	1500	1400	1100	1300	1800	4300	1100
102	2200	3500	3800	4800	2600	3400	3800	4100	2000	3500	3800	3900
103	2100	3500	3800	4500	2300	3600	3600	3900	2200	3900	4100	3800
104	2700	3100	4100	4600	2500	3100	3700	4500	2700	3200	2600	4600
105	2700	4100	2900	5000	2300	4000	2500	4600	2500	3700	5300	4800
106	6700	3500	4100	17000	1500	3700	4900	3100	1400	3800	-	2400
107	1900	4300	-	2100	2200	4400	-	1400	2400	8700	2600	1700
108	1000	2200	2200	3400	1100	2400	2400	3500	1200	2200	3900	3400
109	2700	3000	3600	3400	3800	3400	3800	3200	4100	3900	2500	3300
110	780	1400	2500	-	780	1000	2300	-	1200	1000	2300	-
111	1400	2000	2100	3500	1800	2100	2400	3700	1800	2300	2000	3500
112	1200	1500	2100	2900	760	1700	2000	2600	830	1700	5100	2900
113	1500	3500	5000	4200	1600	3100	5500	3400	1600	3200	2500	3200
114	3300	3500	2100	-	2600	3400	2300	-	2700	3800	-	-

Values represent means of triplicate samples in 1981 and duplicate samples in 1986, 1992 and 1997.
No Table F Guideline exists for Calcium and the OTR_{98} Guideline of 55,000 µg/ Ca was not exceeded at any site in any year.

Table 14: Lead Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
22	**130**	48	120	-	36	14	**220**	-	12	15	**190**	-
23	68	52	42	-	50	43	62	-	27	26	61	-
24	14	4.7	65	-	13	7.3	110	-	5	7.7	61	-
25	36	8.7	15	-	12	7.7	5	-	6.7	6	5	-
26	21	17	11	-	5	9.7	7	-	5	6.7	3.3	-
27	9	100	24	34	6.7	49	13	10	6	25	9.7	6
28	17	-	29	-	6.7	-	21	-	5	-	11	-
29	37	81	9.7	38	17	59	6.7	39	11	43	-	34
30	14	8	8.7	30	13	6.3	5.3	32	5.3	5.3	7.7	53
31	23	17	96	18	18	19	27	6.5	13	20	14	4.5
32	15	20	55	-	5	9.3	13	-	5	9.3	10	-
33	17	21	23	64	5	18	17	15	5	11	19	11
34	29	33	16	37	5	19	12	9.5	10	13	10	4
35	10	11	44	5	5	9	9.3	3.5	5	7.7	11	4
36	78	110	81	-	49	89	43	-	69	62	21	-
37	8.3	5	15	-	5	5	8.7	-	5	5	8	-
38	19	7.3	22	-	11	5.7	24	-	5	5.3	20	-
39	37	34	26	18	5	9	7.3	3	5	8.7	13	3
40	24	11	10	-	16	9	9.3	-	17	7.7	11	-
41	5	29	10	-	5	20	5.3	-	5	19	6	-
42	31	16	13	-	5	12	8	-	16	13	13	-
43	18	24	18	39	5	12	10	13	7	8	8	6
44	26	9.3	43	73	5	14	20	38	6.7	14	10	26
45	5	9.3	70	-	6.7	7.3	39	-	22	7	24	-
46	28	12	18	8.5	15	9.7	16	7.5	6	9.3	20	5.5
47	58	18	-	-	5	16	-	-	11	14	-	-
48	5	8.3	35	31	5	7.3	27	23	5	5.3	36	21
49	9.7	18	13	20	6	6.3	4.7	26	7	5.7	4.3	32
50	58	12	11	8	45	8.7	4.3	4.5	13	7.7	4.3	4
51	5	-	-	-	5	-	-	-	5	-	-	-
52	19	15	11	5.5	18	12	5	4	21	13	3.7	3.5
53	21	20	21	-	20	21	23	-	17	14	26	-
54	8.7	33	-	42	8.3	13	-	23	7.7	11	-	12
55	5.3	17	9.3	78	5	14	6	11	5	13	3.3	8.5
56	23	15	18	-	7.7	8.3	6.3	-	6.7	6.7	5.7	-
57	5	5.7	16	-	5	5	20	-	5	6	18	-
58	6.7	26	25	25	5	16	19	16	10	12	16	14
59	32	7	25	31	6.7	7	22	24	5	7.7	20	22
60	19	9.7	60	73	5	8	26	23	5	10	-	16
61	26	41	54	41	7	15	-	25	5	12	-	18
62	12	5.7	23	10	5	4.7	20	6	5	4.7	19	6.5
63	5	15	20	35	5	13	16	17	5	12	15	18
64	14	24	27	46	5	19	16	28	5	16	15	16
65	26	51	24	50	5	9.7	14	11	5	12	11	9
66	33	8.7	15	-	5	12	14	-	5	16	9	-
67	5	19	18	9	5	14	24	8	5	9.7	-	7
68	5	37	-	16	5	39	-	6.5	5	25	-	5.5
69	16	20	22	15	5	9.7	16	7	5	8.7	15	8

Table 14: Lead Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
70	5	16	16	20	6.7	11	12	7	5	10	13	6
71	8.3	14	7.7	-	5	13	4	-	5	14	3.7	-
72	32	14	15	71	33	11	18	44	31	11	18	42
73	21	18	-	18	10	12	-	14	6.7	9	-	12
74	44	45	68	35	5	13	11	10	5	12	12	10
75	66	33	70	58	19	22	14	16	17	16	13	15
76	91	6.7	-	-	21	4.7	-	-	30	4.3	-	-
77	34	49	59	22	8.3	38	40	14	6.7	40	11	13
78	18	32	-	35	6.7	8	-	15	11	7.7	-	13
79	33	24	-	-	8.3	4	-	-	5	6.3	-	-
80	41	59	42	62	38	43	40	51	28	54	39	61
81	12	12	17	26	13	8.7	13	20	14	11	9.3	16
82	31	10	14	25	35	7	7.3	8.5	21	6.7	5.3	9.5
83	9.3	15	9.7	-	7.7	13	7	-	6	13	6.3	-
84	26	35	-	-	21	36	-	-	24	31	-	-
85	35	31	34	-	13	12	35	-	12	9.7	23	-
86	6	19	13	-	5	12	10	-	5	13	-	-
87	**180**	**<u>810</u>**	42	**<u>460</u>**	**170**	**<u>1000</u>**	20	**<u>540</u>**	110	**<u>860</u>**	15	**<u>280</u>**
88	18	8.3	27	77	21	7.7	14	53	22	7.3	8	45
89	5	54	21	53	5	32	20	49	9	17	13	35
90	13	33	100	47	12	43	30	25	12	30	14	13
91	67	27	49	80	82	23	12	26	120	23	17	18
92	24	11	35	-	11	15	17	-	8	13	14	-
93	6	46	18	46	11	15	14	13	6.7	11	12	13
94	6.7	7.7	14	22	6.7	9.7	7.3	16	5	7	6.3	7
95	9.7	17	7.3	42	6	15	8	14	11	14	7	12
96	9	69	37	**130**	22	50	6.3	**160**	50	51	6.3	**200**
97	11	19	39	86	7	20	36	73	7	30	37	110
98	22	13	15	30	9.3	14	5.7	14	11	15	8.3	7.5
99	29	16	73	53	5	8	9.7	22	5	6.7	10	15
100	5	6.7	25	39	5	6	11	11	5	7.7	10	8
101	15	23	23	**<u>510</u>**	5	9.7	12	110	5	8.7	9.7	25
102	13	62	25	51	49	18	15	26	12	13	18	20
103	22	77	19	30	12	22	15	19	13	19	14	19
104	18	26	26	34	13	18	12	21	18	17	10	16
105	21	21	17	26	17	22	11	25	20	19	10	23
106	28	66	95	36	6	10	13	15	6	11	10	13
107	33	10	-	47	21	11	-	28	16	10	-	21
108	7.7	12	12	59	6.7	8.7	6	50	6	7	4.7	39
109	23	19	17	40	8	15	13	9.5	8	14	11	8.5
110	9.3	33	10	-	16	30	7	-	44	32	5	-
111	5	26	6	38	12	16	4.3	16	5	13	2.3	14
112	9.3	11	3	32	5	10	2	15	5	8	5	11
113	5	5	**290**	51	5	4.7	**350**	51	5	10	**240**	35
114	15	15	120	-	5	8.3	10	-	5	10	12	-

Values represent means of triplicate samples in 1981 and duplicate samples in 1986, 1992 and 1997.
Concentrations shown in bold exceed the Table F Background Guideline of 120 ug/g Pb. Values shown in bold and underlined exceed the Table A Soil Clean up Guideline of 200 ug/g Pb.

Table 15: Magnesium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
22	2300	2700	3000	-	1400	3200	2400	-	1900	3400	2300	-
23	2300	2600	2400	-	1600	2700	2400	-	1800	2700	3600	-
24	900	2800	1900	-	1200	2700	1600	-	1300	2700	1800	-
25	1200	1000	990	-	1400	1700	1100	-	1600	1900	1900	-
26	940	1500	1200	-	1500	2000	1300	-	1300	2300	1800	-
27	800	1800	1900	1200	1300	1600	2500	2000	1500	2200	3100	2800
28	3100	-	680	-	1600	-	830	-	2500	-	1900	-
29	1200	1700	3800	4500	1300	1800	3700	3800	1500	2100	-	3600
30	1400	2700	3700	5800	1500	2900	3700	2700	1800	3000	3800	2200
31	2000	2700	1700	1000	1800	1700	1600	1500	1100	1800	2300	2100
32	670	1500	800	-	1300	2100	830	-	2000	2100	1600	-
33	1300	3900	4800	1800	2500	2600	5200	2100	2600	2400	3200	3000
34	520	1100	2700	4000	610	1300	3900	3900	870	1800	4300	3800
35	940	3700	470	3200	1500	3600	600	3200	1600	3600	1700	3200
36	1500	2700	2200	-	1200	2100	2400	-	1400	2100	2500	-
37	540	**22000**	1800	-	820	2600	1900	-	1300	2800	2100	-
38	1000	2500	2600	-	1000	2700	2500	-	1100	2700	2400	-
39	520	1200	650	900	820	1300	680	1200	630	1700	1600	1800
40	1800	1500	2000	-	1900	1700	2000	-	1900	1800	1300	-
41	1000	2200	3200	-	1100	1900	2500	-	1200	1800	2500	-
42	2700	5800	3300	-	2600	6000	3800	-	2700	5800	3400	-
43	1200	1400	2500	2400	1500	1800	1800	2300	1700	2000	2000	2500
44	2600	2700	3000	3500	2400	2500	2000	3300	2600	2800	1800	2500
45	2400	3000	2500	-	2400	3400	2200	-	2200	3400	2100	-
46	520	2000	2000	1900	1200	1700	1900	1800	1700	1800	1900	1800
47	770	1900	-	-	1200	2100	-	-	720	2100	-	-
48	2000	2900	2700	3200	2000	2700	2300	3000	1800	2700	2600	2700
49	7000	4700	1700	5500	4700	4400	1400	3600	6000	4000	1500	3400
50	2000	1700	750	1300	3200	2100	780	1400	4200	2900	980	1600
51	990	-	-	-	870	-	-	-	1300	-	-	-
52	4800	7400	4900	4800	4400	5400	3100	4700	4500	6900	3300	4500
53	3800	4600	3300	-	4600	5100	3200	-	4700	7300	3100	-
54	3200	4100	-	3700	3600	4900	-	3900	3200	5000	-	3900
55	1400	3800	5600	2800	3200	4300	6400	4400	3400	4600	6400	4600
56	1400	2900	3300	-	1200	2900	2900	-	1500	2900	2700	-
57	2800	4000	2500	-	3100	4300	2500	-	3300	4200	2100	-
58	4300	3800	5800	4900	3800	4100	6300	5100	3800	4100	5800	5100
59	4300	5100	3700	3800	17000	5300	3600	4400	5000	5500	4000	4900
60	6900	4900	5900	2500	8900	5000	6600	2800	11000	4800	-	4100
61	4200	7100	6200	4900	5300	7700	-	6000	5200	7700	-	6900
62	4300	3400	16000	2100	6500	3500	12000	2500	7500	3400	11000	2700
63	2000	6500	7400	7300	2300	7300	8900	7700	2400	7300	9900	7600
64	3500	5200	4300	2800	3700	4400	4300	2800	3500	5000	5100	2800
65	2000	2700	3800	2000	2100	4300	3700	2100	3900	5900	4100	2800
66	2300	3900	8100	-	3000	5800	8300	-	4100	5900	8300	-
67	2600	4000	4500	4300	2700	2800	5000	3900	3000	2600	-	3400
68	2200	5100	-	2400	2600	5800	-	2800	3300	5600	-	3400
69	4900	13000	5900	6100	5400	17000	6900	6700	5400	18000	7200	5900

Table 15: Magnesium Concentration in Soil Profiles Collected at 92 Stations in the Sudbury Area as part of the Special Survey

Station	0 to 5 cm				5 to 10 cm				10 to 15 cm			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
70	6400	5400	8100	2000	6000	4800	8300	3400	7000	5900	9700	4800
71	2500	5000	5100	-	2700	5300	5200	-	4100	5900	5400	-
72	5500	7000	10000	6100	4400	7000	11000	3900	3600	6800	10000	4000
73	2600	2400	-	4800	2700	2600	-	4800	3200	2800	-	4400
74	2200	2100	3200	3200	3800	2400	4800	3900	5000	5700	4300	4800
75	800	1200	2200	3700	750	2200	2700	4500	840	2600	2700	6000
76	3700	4300	-	-	2700	3400	-	-	3100	3200	-	-
77	1100	1200	2000	1400	840	1400	1400	1100	810	1100	1400	1100
78	6100	2100	-	6400	5900	4800	-	7100	6500	2000	-	7500
79	3200	1400	-	-	3200	1700	-	-	3600	2000	-	-
80	2100	1500	2200	1900	1800	1500	2100	2000	2400	1800	1900	2300
81	3500	8900	4200	6300	3900	6200	3100	4600	3700	7700	3400	4600
82	3100	1400	1800	3300	3400	1800	1600	3200	3200	2200	2100	3200
83	2200	4400	2400	-	2300	8200	2200	-	2800	8600	1900	-
84	3400	3600	-	-	4000	4000	-	-	4300	3500	-	-
85	6900	5800	7600	-	8200	4600	5900	-	6300	4600	5300	-
86	10000	8600	3500	-	8300	11000	8000	-	8500	11000	-	-
87	2600	3600	3400	3400	2600	3200	3100	2900	2400	3400	3800	2600
88	4100	3200	6200	4100	4400	3200	5000	3600	4000	3000	4300	3600
89	8100	4000	5400	4400	5200	4000	5500	4500	6400	4600	4900	4400
90	6900	4600	4600	5900	7600	5100	4700	5700	6800	4300	5000	7000
91	2200	9100	3400	2700	2400	9100	2900	2900	2200	11000	3700	5100
92	4000	14000	5500	-	4100	12000	5900	-	4000	9700	7300	-
93	2600	3500	2700	3400	2500	2700	2700	3100	2100	2800	2800	2800
94	1100	2000	1700	1800	950	2200	2000	1400	1100	2000	2400	1500
95	1600	3600	3500	1400	1700	4800	3900	1900	2000	4200	3900	2800
96	3000	4900	4300	4700	3100	5800	4000	5000	3000	5200	4000	5700
97	2300	10000	12000	14000	2800	11000	13000	9900	2600	6400	11000	8900
98	6400	2800	2400	3400	7600	2700	2500	3000	7400	2600	2600	3200
99	3000	4700	4500	5400	3000	3900	3100	4400	3000	3800	3400	4400
100	4800	3900	5000	2500	4200	3700	5200	2900	4800	3700	5600	3100
101	1900	2700	1100	1600	1600	2400	1800	1400	1700	2900	2200	1900
102	4800	6000	5300	7400	4300	6400	7600	7900	5700	6000	11000	8600
103	6500	6800	6200	8200	7100	7500	6100	8500	7100	8200	6900	8700
104	11000	6100	5900	6800	7600	6400	6100	7000	6700	6600	6900	7600
105	4100	6900	5200	8700	4000	7100	5300	8600	4000	7400	5500	9300
106	8400	5200	6300	12000	5000	4900	6800	4700	4300	5600	5900	4300
107	3500	5700	-	2700	4100	6600	-	2000	4100	8300	-	2200
108	2600	3900	3100	4700	2800	4200	3200	4800	3000	3800	3400	4600
109	4700	5800	4700	5400	5900	6900	5000	5400	5700	7800	6400	5500
110	4200	2500	3600	-	4200	1900	3500	-	3700	2000	3500	-
111	3700	4400	2900	4900	3700	4500	2900	4900	4000	4600	2800	4800
112	1200	3500	2900	3400	1600	3600	2700	4100	2400	3800	2600	5100
113	2800	5500	5000	5000	2900	5300	5000	4400	3000	5200	5200	4300
114	5000	6900	2400	-	5000	7800	4700	-	5100	11000	5500	-

Values represent means of triplicate samples in 1981 and duplicate samples in 1986, 1992 and 1997.
No Table F Guideline exists for Magnesium and therefore, values in bold exceed the OTR_{98} Guideline of 20,000 µg/ Mg.

Table 16: Barium, Beryllium, Chromium, Manganese, Molybdenum, Strontium, and Vanadium Concentrations in Soil Profiles Collected in 1997 at 92 Stations in the Sudbury Area as part of the Special Survey

Station	Barium			Beryllium			Chromium			Manganese			Molybdenum			Strontium			Vanadium		
	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27	56	52	62	<0.5	<0.5	<0.5	19	28	36	110	190	260	0.65	<0.5	<0.5	14	16	18	27	38	41
28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	26	28	35	<0.5	<0.5	<0.5	32	29	29	160	170	170	0.8	<0.5	<0.5	17	14	14	37	35	38
30	36	44	45	<0.5	<0.5	<0.5	36	32	29	180	170	160	1.6	0.6	<0.5	21	13	14	39	40	37
31	27	28	34	<0.5	<0.5	<0.5	16	22	26	120	150	140	<0.5	<0.5	<0.5	8	9	11	31	34	33
32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	120	65	81	<0.5	<0.5	<0.5	25	28	34	210	350	350	0.6	<0.5	0.6	17	14	17	31	36	40
34	33	37	45	<0.5	<0.5	<0.5	34	31	30	170	160	170	<0.5	<0.5	<0.5	21	19	20	37	35	35
35	45	49	47	<0.5	<0.5	<0.5	25	25	24	170	180	180	<0.5	<0.5	<0.5	15	14	14	31	30	30
36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	19	23	35	<0.5	<0.5	<0.5	14	19	24	70	120	130	<0.5	<0.5	<0.5	8.5	9	9	19	27	28
40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	52	49	40	<0.5	<0.5	<0.5	25	24	27	140	190	150	<0.5	<0.5	<0.5	18	20	19	27	28	27
44	63	70	65	<0.5	<0.5	<0.5	57	43	34	150	150	130	**4.2**	1.5	0.65	24	20	15	46	49	44
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	19	20	20	<0.5	<0.5	<0.5	20	21	21	84	80	80	<0.5	<0.5	<0.5	10	10	10	24	24	25
47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	44	43	45	<0.5	<0.5	<0.5	27	26	26	140	110	120	<0.5	<0.5	<0.5	19	17	16	26	25	25
49	49	64	76	<0.5	<0.5	<0.5	28	31	32	140	140	150	<0.5	<0.5	<0.5	19	21	25	27	30	31
50	29	28	27	<0.5	<0.5	<0.5	16	18	19	64	71	75	<0.5	<0.5	<0.5	11	11	12	25	26	28
51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	61	59	56	<0.5	<0.5	<0.5	43	41	39	290	280	270	<0.5	<0.5	<0.5	30	25	26	38	35	34
53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 16: Barium, Beryllium, Chromium, Manganese, Molybdenum, Strontium, and Vanadium Concentrations in Soil Profiles Collected in 1997 at 92 Stations in the Sudbury Area as part of the Special Survey

Station	Barium			Beryllium			Chromium			Manganese			Molybdenum			Strontium			Vanadium		
	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm
54	71	86	56	<0.5	<0.5	<0.5	34	38	34	200	300	250	0.85	<0.5	<0.5	16	17	18	39	36	31
55	66	45	41	<0.5	<0.5	<0.5	43	47	48	100	150	160	0.95	<0.5	<0.5	18	22	19	32	34	33
56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	76	74	76	<0.5	<0.5	<0.5	43	45	45	320	250	250	<0.5	<0.5	<0.5	33	31	32	37	37	37
59	120	120	130	<0.5	<0.5	<0.5	40	49	54	360	230	220	<0.5	<0.5	0.55	27	23	25	39	45	52
60	120	73	68	<0.5	<0.5	<0.5	25	27	39	330	320	270	0.8	<0.5	0.55	21	17	19	30	38	52
61	120	82	78	<0.5	<0.5	<0.5	27	32	37	400	340	320	0.65	<0.5	<0.5	26	18	19	67	74	82
62	37	42	43	<0.5	<0.5	<0.5	24	27	28	100	120	120	<0.5	<0.5	<0.5	14	14	15	29	29	28
63	85	82	82	<0.5	<0.5	<0.5	**72**	**74**	**73**	360	410	390	<0.5	<0.5	<0.5	25	29	28	48	50	50
64	54	55	46	<0.5	<0.5	<0.5	29	28	29	160	170	150	<0.5	<0.5	<0.5	19	23	20	27	28	27
65	59	41	44	<0.5	<0.5	<0.5	22	22	26	120	130	140	<0.5	<0.5	<0.5	17	20	19	22	24	26
66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	42	42	33	<0.5	<0.5	<0.5	35	33	28	230	190	160	<0.5	<0.5	<0.5	20	20	19	35	34	31
68	42	38	47	<0.5	<0.5	<0.5	22	23	29	120	130	160	0.75	<0.5	<0.5	24	25	28	22	26	30
69	90	86	84	<0.5	<0.5	<0.5	48	54	49	480	410	420	<0.5	<0.5	<0.5	40	41	38	44	48	44
70	57	57	65	<0.5	<0.5	<0.5	24	40	48	120	150	180	<0.5	0.6	0.7	17	17	20	32	44	50
71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
72	54	57	61	<0.5	<0.5	<0.5	42	40	42	190	200	210	1.1	<0.5	<0.5	22	23	24	38	39	38
73	59	67	61	<0.5	<0.5	<0.5	39	40	36	320	370	330	<0.5	<0.5	<0.5	30	31	30	34	36	33
74	69	58	61	<0.5	<0.5	<0.5	34	38	44	340	220	220	<0.5	<0.5	<0.5	34	37	35	34	37	40
75	150	95	100	<0.5	<0.5	0.55	42	48	62	530	430	370	<0.5	<0.5	<0.5	35	31	32	34	37	43
76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
77	32	32	29	<0.5	<0.5	<0.5	20	19	20	120	120	110	<0.5	<0.5	<0.5	11	10	10	28	28	29
78	92	110	110	<0.5	<0.5	<0.5	56	59	61	470	650	610	<0.5	<0.5	<0.5	34	41	44	43	47	49
79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
80	92	110	140	<0.5	<0.5	<0.5	26	26	28	150	190	270	<0.5	<0.5	0.75	18	18	20	29	29	30
81	110	100	98	<0.5	<0.5	<0.5	55	45	43	270	230	230	<0.5	<0.5	<0.5	38	31	32	45	40	39
82	73	63	61	<0.5	<0.5	<0.5	34	32	31	170	160	170	0.55	<0.5	<0.5	22	22	23	32	31	30
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87	120	180	120	<0.5	<0.5	<0.5	41	40	31	180	200	180	1.4	1.6	0.7	19	23	16	43	46	48

Table 16: Barium, Beryllium, Chromium, Manganese, Molybdenum, Strontium, and Vanadium Concentrations in Soil Profiles Collected in 1997 at 92 Stations in the Sudbury Area as part of the Special Survey

Station	Barium			Beryllium			Chromium			Manganese			Molybdenum			Strontium			Vanadium		
	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm	0-5 cm	5-10 cm	10-15 cm
88	67	66	54	<0.5	<0.5	<0.5	44	40	39	210	180	190	0.85	0.65	0.85	18	17	16	47	48	49
89	100	110	120	0.55	0.6	0.75	42	43	41	240	230	230	1.1	0.9	0.95	38	42	44	37	38	39
90	87	76	72	<0.5	<0.5	<0.5	57	51	59	870	700	470	0.55	<0.5	<0.5	33	36	39	47	45	49
91	110	71	78	<0.5	<0.5	<0.5	33	30	49	300	310	340	1.4	0.65	<0.5	28	22	28	44	41	50
92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	37	34	39	<0.5	<0.5	<0.5	32	34	31	200	160	150	<0.5	<0.5	<0.5	26	26	23	33	33	31
94	33	30	23	<0.5	<0.5	<0.5	26	22	26	300	230	230	<0.5	<0.5	<0.5	14	15	13	33	34	38
95	50	31	34	<0.5	<0.5	<0.5	24	33	43	170	170	190	<0.5	<0.5	<0.5	14	17	18	38	54	51
96	74	75	82	<0.5	<0.5	<0.5	42	41	43	210	200	230	0.65	<0.5	0.8	24	25	25	32	34	37
97	**260**	**230**	**230**	<0.5	0.6	0.55	**150**	**110**	**110**	470	330	400	<0.5	0.55	0.65	41	36	36	87	69	69
98	77	60	55	<0.5	<0.5	<0.5	36	28	29	290	200	200	<0.5	<0.5	<0.5	25	23	25	35	29	30
99	92	90	87	<0.5	<0.5	<0.5	57	42	42	320	320	350	0.6	<0.5	<0.5	28	29	28	42	37	35
100	51	37	35	<0.5	<0.5	<0.5	29	26	26	100	120	140	<0.5	<0.5	<0.5	22	23	23	25	25	25
101	140	45	25	<0.5	<0.5	<0.5	40	22	23	150	93	100	1.7	0.6	0.65	14	11	10	26	30	33
102	130	120	130	0.6	0.6	0.65	64	67	**74**	540	500	540	<0.5	<0.5	<0.5	43	40	38	53	58	60
103	120	120	120	0.65	0.75	0.75	66	70	**73**	1000	920	840	<0.5	<0.5	<0.5	40	37	37	58	58	59
104	96	87	91	<0.5	<0.5	0.55	51	51	55	460	460	460	<0.5	<0.5	<0.5	39	39	39	49	53	53
105	120	120	130	0.7	0.7	0.75	65	68	73	570	510	510	<0.5	<0.5	<0.5	39	37	39	60	60	64
106	56	51	48	<0.5	<0.5	<0.5	33	37	36	220	200	180	0.55	<0.5	0.55	23	18	18	37	40	39
107	44	45	57	<0.5	<0.5	<0.5	41	30	30	120	96	110	0.6	0.65	<0.5	16	14	18	39	35	38
108	54	62	61	<0 .5	<0.5	<0.5	39	43	39	220	220	210	<0.5	<0.5	<0.5	26	28	27	33	36	35
109	69	77	75	<0.5	<0.5	<0.5	47	44	45	220	240	260	<0.5	<0.5	<0.5	31	33	34	40	38	40
110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
111	61	69	71	<0.5	<0.5	<0.5	44	41	40	290	350	360	<0.5	<0.5	<0.5	26	26	26	36	35	35
112	69	61	67	<0.5	<0.5	<0.5	29	33	39	340	290	310	0.55	<0.5	<0.5	26	24	27	28	31	36
113	94	90	86	<0.5	<0.5	<0.5	41	36	36	420	390	350	0.55	0.55	<0.5	34	29	29	38	35	37
114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table F	210			1.2			71			2200 *			2.5			64 *			91		
Table A	750			1.2			750			NG			40			NG			200		

* Table F Guidelines do not exist for Manganese and Strontium, therefore OTR_{98} are stated for these elements.

Table 17: Arsenic Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**6.2**	**5.1**	1.7	1.2	0.52		7.8	3.7	1.4	0.71	0.38	
23	**6.4**	**5.5**	**2.3**	0.94	0.36		4.6	2.2	1.5	0.47	0.35	
24	**9**	**4.4**	1.6	1.7	0.37		4	1.8	0.55	0.93	2	
25	**4**	**2.1**	<0.3	0.42	0.24		3.4	1.2	0.87	0.39	0.48	
26	**4.3**	**2.5**	<0.3	1			4.3	0.9	0.6	0.56	<0.2	
27	**2.4**	1.3	1.1	**2.8**	<0.2	<0.2	2.4	0.97	1.4	1.3	<0.2	0.25
28	2	0.4	<0.3		<0.2		2.7	0.37	<0.3		<0.2	
29				1.5		0.35		**20**	3.8	0.67	0.4	<0.2
30			**3**	0.88	0.21	0.25	**12.8**	**11**	2.5	2.1	0.49	0.65
31	**11.7**	**12**	1.3			<0.2	**8.7**	5.8	0.77		0.62	0.8
32	**11.5**	**8.6**	**2**	1.3	0.3		5.2	3.2	1.3	2.4	0.97	
33		**3.7**	0.8	1.2	0.41	<0.2	4	1.9	0.5	0.56	<0.2	0.3
34	**11.7**	**4.3**	<0.3	1.8	<0.2	<0.2	4	1	<0.3	0.91	<0.2	<0.2
35	**3.3**	0.83	0.33	0.78	<0.2	<0.2	1.8	0.6	<0.3	0.57	0.23	<0.2
36		**4.2**	**3**	1.5	0.32			3.3	1.1	1.4	0.52	
37			1.8		0.24			1.4	0.6		<0.2	
38		1.6	0.37		0.24		3.6	0.53	0.83		0.27	
39		1.1	<0.3			<0.2	4.3	0.77	<0.3		0.26	0.4
40		1.3	0.33		<0.2		4	0.73	0.37		0.21	
41		1.3	0.33		<0.2		4.1	0.53	<0.3		<0.2	
42		1.2	0.33		<0.2		2.3	0.5	0.83			
43		0.8	0.4	0.36	0.22	<0.2	1.8	1.1	0.57	0.16	<0.2	<0.2
44		**22**	**4.4**	**2.8**		0.65	6.4	**17**	2.1	1.8	0.46	0.3
45	**5**	**13**	**2.8**	**7.4**	0.39		4.8	7.6	2.2	2.4	0.48	
46	**9.3**	**6.1**	1.1		0.31	0.3	6.4	5.7	0.8		<0.2	<0.2
47		**2.7**						4.5				
48	**4.3**	**2.7**	<0.3	1	0.28	<0.2	4.3	1.2	<0.3	0.53	<0.2	<0.2
49	**6.6**	**2.2**	<0.3	0.48	<0.2	<0.2		1.6	<0.3	0.48	<0.2	<0.2
50	**6.4**	1.4	<0.3		<0.2	<0.2	3.2	1	<0.3		0.21	<0.2
51	**4.8**	1.8	1.2				3.4	1.4	<0.3			
52	**8.3**	**2.1**	0.4	1.2	<0.2	<0.2	1	1	0.37	0.43	<0.2	<0.2
53	**6.6**	**2.3**	0.43	1.1	<0.2		1.8	1.2	0.47	0.32	<0.2	
54	**5**	**2.2**	0.5			<0.2	2.3	1.1	0.43			<0.2
55	**5.2**	**2.4**	0.37		0.21	<0.2	2.3	4	0.63			0.25
56	2	1.1	0.37		<0.2		0.8	1.1	<0.3		<0.2	
57	1	0.7	<0.3		<0.2		1.8	0.9	<0.3		<0.2	
58	**2.1**	0.43	<0.3	**3.2**	<0.2	<0.2	2.3	0.57	<0.3	1.7	<0.2	<0.2
59	1.2	0.37	<0.3	0.25	<0.2	<0.2	0.08	0.33	<0.3	0.4	<0.2	0.25
60	1	<0.3	<0.3	0.32	<0.2	<0.2	0.8	0.33	<0.3	<0.03	<0.2	<0.2
61	0.8	**8.5**	<0.3	<0.03	<0.2	<0.2	0.8	<0.3	<0.3	<0.03	<0.2	<0.2
62	**5**	**7.6**	<0.3	0.71	<0.2	<0.2	3.6	1.6	<0.3	0.33	<0.2	0.35
63	**3.2**	**2.5**	0.6	0.53	<0.2	<0.2	2	2.9	0.4	0.37	<0.2	<0.2
64	**3.4**	1.7	0.43	0.25	<0.2	<0.2	2.3	1.4	<0.3	0.09	0.21	<0.2
65	2	0.83	<0.3	0.21	0.21	<0.2	2.7	1	<0.3	0.18	<0.2	<0.2
66	2	0.73	0.4	0.28	<0.2		2	0.6	<0.3	0.43	0.22	
67	1.2	0.4	<0.3	0.24	<0.2	<0.2	1.8	0.37	<0.3	0.22	<0.2	<0.2
68	**2.3**	0.4	<0.3	0.14		0.25	1.8	0.33	<0.3	0.07		0.25
69	2	<0.3	<0.3	<0.03	<0.2	<0.2	1.2	<0.3	<0.3	0.04	<0.2	<0.2
70	2	<0.3	<0.3	<0.03	<0.2	<0.2	0.8	<0.3	<0.3	0.04	<0.2	<0.2
71	<0.5	1.5	<0.3	<0.03	<0.2		1.8	<0.3	<0.3	<0.03	<0.2	

Table 17: Arsenic Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
72	**6.4**	0.7	0.6	0.34		0.4	2	0.57	0.8	0.39	0.7	0.35
73	**5**	0.57	<0.3	0.3		0.35	4.3	0.47	<0.3	0.71		0.45
74	1.9	0.7	<0.3		<0.2	<0.2	2.7	0.53	<0.3		0.24	0.4
75		1.1	<0.3		<0.2	<0.2	3.6	0.73	<0.3		<0.2	0.25
76		1.2	<0.3	0.77				0.77	<0.3	0.14		
77	**3.4**	0.67	<0.3	0.73	0.23	<0.2	2.8	0.63	<0.3	0.14	0.31	<0.2
78	**3.5**	1.4	<0.3	0.34		<0.2	2.3	0.87	<0.3	0.15		<0.2
79	**4.6**	1.3	<0.3	0.49			2.3	<0.3	<0.3	0.28		
80	**4.6**	1.7	<0.3	0.21	<0.2	<0.2	2	0.83	<0.3	0.15	0.21	<0.2
81	**5**	**2.8**	0.43	1.1	0.22	<0.2	3.2	0.57	<0.3	0.15	0.29	<0.2
82			0.93	0.65	<0.2	<0.2	3.3	0.73	0.37	0.25	<0.2	<0.2
83		**2.1**		1.1	0.35		4.5	-	1.2	0.46	0.26	
84		**3.4**	0.57	0.42			2.9	1.4	0.47	0.31		
85		1.5	0.63	0.47	<0.2		2.2	0.93	0.4	0.15	0.24	
86		1.6	0.33	0.44	<0.2		0.8	0.9	0.4	0.12	<0.2	
87		**2.4**	0.93	0.62	0.29	0.3	3.2	0.87	1.9	0.58	<0.2	1.5
88		1		0.71		0.25	2.3	1.3	0.43	0.43	0.37	<0.2
89	**3.2**		0.47	0.39	0.24	<0.2	3.3	0.97	0.73	0.22	0.25	0.25
90		<0.3	<0.3		<0.2	<0.2	2.7	1.8	<0.3		<0.2	<0.2
91	2	0.37	<0.3	0.28	<0.2	<0.2	2.3	0.47	<0.3	<0.03	<0.2	0.55
92	**2.4**	0.43	<0.3	0.19	0.23		2.3	0.37	<0.3	0.11	0.39	
93	2	<0.3	<0.3	0.13	0.25	<0.2	1.2	<0.3	<0.3	0.05	0.41	<0.2
94	1.8	<0.3	0.37	0.08	0.21	<0.2	1.2	<0.3	<0.3	0.2	0.31	<0.2
95	<0.5	**3.1**	<0.3	0.11	0.26	<0.2	1.2	<0.3	<0.3	0.15	0.23	<0.2
96	**2.7**	0.77	1.5	0.75	0.27	0.5	3.6	4	0.67	0.43	0.4	0.6
97	**2.4**	1.4	1	1.4	0.66	0.45	4	1.4	1.7	0.6	0.48	1.2
98	**2.4**	0.9	0.57	0.92	<0.2	<0.2		0.57	0.6	0.28	0.47	0.3
99	**2.3**	1	0.37	0.77	<0.2	<0.2	2.3	0.87	0.83	0.14	0.74	0.3
100	0.8	0.57	0.33	0.58	<0.2	<0.2	1	0.57	<0.3	0.23	<0.2	0.35
101	**2.3**	<0.3	<0.3	0.83	<0.2	<0.2	2.3	0.6	<0.3	0.25	0.21	<0.2
102	1.8	0.4	<0.3	0.12	<0.2	<0.2	1.9	<0.3	<0.3	0.26	<0.2	<0.2
103	**2.7**	<0.3	0.33	0.57	<0.2	<0.2	3.2	<0.3	<0.3	0.16	<0.2	<0.2
104	1.8	<0.3	<0.3	0.22	<0.2	<0.2	2	<0.3	<0.3	0.15	<0.2	<0.2
105	1.9		0.37	0.12	<0.2	<0.2	1.2	<0.3	<0.3	0.4	<0.2	<0.2
106		1.7	0.43	0.71	0.21	0.3		-	0.4	0.4	0.39	0.5
107		**2.6**	0.9	0.82		0.7	2.3	2.7	1.1	0.85		0.35
108		1.3	<0.3		<0.2	0.55	2	1.4	<0.3		0.27	0.45
109		**2.5**	<0.3		0.23	0.25	2	0.73	<0.3		0.27	<0.2
110		1.1	1				2	2.1	<0.3		0.22	
111		1.4	<0.3		0.42	<0.2	2.8	2.2	<0.3		0.26	<0.2
112		0.57	<0.3		<0.2	<0.2	0.8	0.5	<0.3		0.21	<0.2
113		<0.3	<0.3		<0.2	<0.2	0.6	0.9	<0.3		<0.2	<0.2
114			0.37	0.37	<0.2			<0.3	<0.3	0.26	<0.2	

* - 1971 Aspen foliage was washed.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 2 ug/g As for foliage and 8 ug/g for forage.

Table 18: Cobalt Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	11	11	5	8.3	4.1		1	2.7	1.3	<1	0.57	
23	<1	5.7	12	3.3	3.3			1.3	2	<1	0.5	
24	10	7.3	8	3	6.4		<1	2.7	<1	<1	0.7	
25	15	10	5	3.7	2.9		<1	1	<1	<1	0.23	
26	5	10	7	6			<1	2	<1	<1	0.27	
27	3	4.7	11	8.3	2.7	7.2	2	1.3	<1	<1	<0.2	0.4
28	<1	6.3	6.3		2.6		2	1	<1		<0.2	
29				3		5		13	2	<1	1.1	0.65
30			11	6.7	11	6.5	2	7.7	1.7	<1	1.1	1.4
31	5	12	10			7.2	1	5.3	1.3		0.6	0.7
32	5	7	6.7	7	3.1		<1	2	<1	1.3	0.53	
33	9	12	7	3.7	2.9	4.1	<1	2	<1	<1	<0.2	0.9
34	10	12	2.7	4.7	5.7	9.8	<1	2	<1	<1	0.33	0.4
35	7	6.7	7	7	4.1	3.1	<1	1.7	<1	<1	0.3	0.25
36		8	7.7	5.3	5.4			4	1.3	<1	1.8	
37			6.3		2.4			2	<1		0.27	
38	6	8	5.3		3.7		<1	2	<1		0.57	
39	2	5	4.7			4.1	1	1.3	<1		0.37	0.45
40	5	11	4		3		3	1.3	<1		0.27	
41	4	7.7	5.7		2		<1	3	<1		<0.2	
42	3	5	4.3		3.5		<1	1.3	1.3			
43	10	3.3	4.7	3.7	1.8	1.5	<1	1.7	<1	<1	0.33	0.45
44		14	12	12		8.6	<1	6	1.3	<1	0.9	0.75
45	7	10	9.3	6	5.2		1	7	1.3	<1	1.2	
46	15	9.3	13		7.7	12	5	3	<1		0.27	1.5
47		11						2.7				
48	4	2.7	7.7	6	9.2	4.9	4	3.3	<1	<1	1.1	0.35
49	4	6.7	4.7	2.3	5	5	4	2.3	<1	<1	0.43	<0.2
50	10	9	4		4.2	2.9	<1	1.3	<1		0.33	0.4
51	6	5.3	4				<1	1.7	<1			
52	4	4.3	2.3	1.7	1.4	4	1	4	1.3	<1	0.33	0.3
53	9	4.7	2.7	1.7	2.6		<1	3	<1	<1	<0.2	
54	9	6.3	5.7			4.5	<1	1.7	<1			0.55
55	5	5.7	4		2.5	2	<1	2	<1			0.4
56	4	6.7	7.3		3.2		<1	2	1.5		0.27	
57	4	4	5.7		1.2		1	1	<1		0.37	
58	<1	4.7	7.7	1.3	2.9	3.4	<1	1	<1	<1	<0.2	<0.2
59	4	9.3	6	4	3.6	2.2	<1	2	<1	<1	<0.2	<0.2
60	3	4.7	2.7	3	2.3	2.3	2	1.3	<1	<1	<0.2	<0.2
61	3	7.7	1.7	1.3	1.6	1.3	<1	1	<1	<1	<0.2	<0.2
62	3	8.7	4.7	2	3.9	1.9	2	3.3	<1	<1	<0.2	0.65
63	9	11	4.8	2	4.1	4.4	3	2.7	<1	<1	0.33	0.35
64	4	7.7	4.3	3	3.7	2.7	2	2	<1	<1	0.23	0.45
65	3	9.7	4	3	5.5	5.5	2	2.3	<1	<1	<0.2	0.55
66	3	12	4	2.3	2.7		2	2.3	<1	<1	<0.2	
67	5	5.3	6	3.3	4.3	5.7	2	2	1.7	<1	0.23	0.3
68	3	3.3	3	1		1.2	<1	1	<1	<1		0.25
69	5	3	1.7	1.7	0.7	0.8	3	1	<1	<1	0.23	0.75

Table 18: Cobalt Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
70	2	**4**	**2.3**	<1	0.7	**2.3**	<1	1.3	<1	<1	<0.2	<0.2
71	**5**	**5.7**	**2.7**	**3.3**	0.83		<1	1	<1	<1	<0.2	
72	**4**	**5.7**	**7.5**	2		**7.1**	<1	1.3	2	<1	1.1	0.7
73	**5**	**5**	**6.3**	**5**		1.1	<1	1.7	<1	1.3		<0.2
74	**6**	**5.3**	**7.3**		1.3	**2.4**	<1	1	<1		<0.2	0.6
75		**7.7**	**7**		**2.6**	1.4	<1	1	<1		<0.2	0.3
76		**11**	**5**	**5**				2	1.3	1.7		
77	**5**	**5**	**5**	**6**	**2.1**	1.3	<1	1	1.5	<1	0.77	<0.2
78	**6**	**15**	1.3	**10**		0.95	<1	1	<1	<1		0.25
79	2	**8.3**	<1	**4**			<1	1.7	5.9	<1		
80	**3**	**3.3**	**6.7**	**2.7**	**3.9**	2.9	3	2	<1	<1	0.47	<0.2
81	**3**	**10**	2	**3**	**3.7**	**4.1**	5	2	<1	<1	0.23	<0.2
82	**17**		**13**	**9.7**	**5.9**	**4**	<1	1.7	<1	<1	0.27	1.5
83	**16**	**6**		**13**	**8.5**		6	-	1.7	4.3	1	
84	2	**11**	**6.3**	**5.7**			5	3.3	2.3	<1		
85	**3**	**8**	**5**	1.7	**3.9**		<1	2.3	2.7	<1	0.27	
86	**3**	**52**	**5**	**3.3**	**3.2**		<1	2.3	1.3	<1	<0.2	
87		**13**	**4.7**	**9**	**8**	**12**	<1	2.7	2.3	2	1.7	1.3
88		**9.7**		**5.3**		**2.4**	<1	5.7	<1	2.3	1.4	0.35
89	**7**		**7.3**	**5.3**	**5**	**4**	<1	2	<1	<1	0.43	0.8
90	**12**	**10**	**4.7**		**2.4**	**4**	<1	3	<1		0.3	1.6
91	2	**6.3**	**6.7**	**3**	**2.1**	**2.2**	2	3.3	<1	1.3	0.43	0.55
92	2	**4**	**2.3**	1.3	1		<1	3.3	<1	<1	<0.2	
93	**4**	**2.7**	<1	**2.3**	0.5	**4.5**	<1	1	<1	<1	<0.2	<0.2
94	2	**4.7**	**2.3**	**2.3**	1.6	1.6	<1	1.7	<1	1.3	0.33	0.3
95	**3**	**10**	**3.7**	1.3	**3**	**3.3**	2	1.7	<1	<1	<0.2	<0.2
96	<1	**8.7**	**13**	**7.3**	**5**	**6**	<1	**9.3**	2.3	1.3	1.1	0.9
97	1	**5.7**	**10**	**8**	**7.9**	**3.4**	<1	2.7	4	1.5	1.3	3.5
98	2	**9**	**6.7**	**6.7**	**5.9**	**6.8**		2.3	2.7	<1	1.2	1.1
99	**7**	**3.3**	**10**	**2.7**	**6.2**	**2.3**	<1	2.7	3	<1	1.2	<0.2
100	**5**	**5**	**4.7**	**2.7**	**2.7**	1.6	<1	1	<1	<1	0.3	0.4
101	<1	**3.7**	**5.7**	**3**	**4.7**	**4.4**	<1	**9.7**	<1	1.7	0.53	0.35
102	**6**	**2.7**	**6.7**	<1	1.1	1	<1	1	<1	2	<0.2	<0.2
103	**3**	**3**	2	2	0.7	0.75	<1	1.3	<1	<1	<0.2	<0.2
104	1	**5**	2	1.7	1.8	0.95	<1	1.3	<1	<1	<0.2	<0.2
105	**8**		**4.3**	**3**	**3.5**	1.3	<1	1.7	<1	<1	<0.2	<0.2
106		**4.3**	**7.2**	**5.3**	**4.2**	**5.5**			<1	1.3	0.4	0.7
107	2	**11**	**4.7**	**3**		**5.7**		**11**	3	<1		0.25
108	**4**	**6.3**	**9**		**4.8**	0.8		4	<1		0.9	0.5
109	2	**11**	**5.7**		**4.6**	**4.6**		2.7	<1		0.37	0.65
110	1	**7.3**	**9**					2	<1		<0.2	
111	**7**	**9.7**	**3**		**6.8**	**2.6**		2.3	<1		0.53	0.45
112	**5**	**11**	**5.7**		**2.5**	**2.9**		2.3	<1		<0.2	0.3
113	**4**	**5**	1.7		1.1	2.1		1.3	<1		<0.2	<0.2
114	**3**		**4.7**	2	0.3			1	3.3	<1	<0.2	

* - 1971 Aspen foliage was washed.
Values represent single samples collecied in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 2 ug/g for Co foliage and 8 ug/g for forage.

Table 19: Copper Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**27**	**41**	11	14	9.5		**42**	**61**	8.7	7.3	9.6	
23	**38**	**34**	14	11	9.8			17	14	7.7	11	
24	**50**	**23**	7.5	9.3	10		5.5	**21**	5.5	9	14	
25	**21**	17	9.5	9.3	7.8		12	12	7.3	9.7	6.9	
26	**29**	17	8.5	14			16	6.7	13	4.7	6	
27	16	13	9	14	6.9	11	2.5	5.3	11	9.7	7	5.5
28	12	12	8.7		7.2		3.5	2.3	3.3		6.7	
29				12		13		**190**	19	9.3	13	8
30			17	13	11	20	**25**	**72**	18	13	15	20
31	**35**	**49**	16			11	8	**30**	19		9.5	8.1
32	**38**	**28**	15	11	5		8	**24**	9.7	17	11	
33		20	12	8	14	9.1	7	4.7	9.3	6.3	6.5	11
34	**43**	20	9.7	12	6	6.3	8	7.7	12	8.7	6.4	3.3
35	13	10	9.3	8.3	10	8	9.5	6.7	5.7	8.3	6.7	5.7
36		20	18	13	8.6			15	12	16	18	
37			**26**		9.6			9.3	12		8	
38	**27**	12	9.7		8.8		**24**	5.7	8.7		**40**	
39	**21**	14	11			8	6	5.7	10		**21**	8.7
40	**38**	16	15		7.6		16	6	17		7.7	
41	**29**	20	12		7.7		**26**	7.3	8.3		5.8	
42	**22**	16	9		6.1		17	6.7	6.7			
43	**42**	17	12	12	11	8.9	14	8	14	8	10	4.3
44		**69**	17	13		14	13	**53**	16	9	18	8.3
45	**30**	**33**	10	**22**	13		19	**39**	11	12	14	
46	**51**	16	12		7.8	11	12	12	6		8.3	8.3
47		11						14				
48	**25**	14	9	11	8.5	5.7	**35**	17	5	20	9.3	5.4
49	**37**	14	6.3	7.3	10	6.9	8	13	5.7	9.7	7.3	2.1
50	**30**	13	8.7		8.5	7.3	7	7	3		14	7.6
51	**24**	13	10				10.5	4.3	4			
52	**35**	13	10	9.7	4.8	5	3	13	7	16	7.3	3.3
53	**24**	10	8.3	8.3	7.3		3	10	18	14	5.8	
54	18	10	9.7			7.4	5.5	2.3	7.7			4.2
55	18	9.7	6.3		7.7	5.3	8	16	7.3			2.2
56	10	9.3	6.7		13		4	2.7	4.3		6.8	
57	8	9	9.3		5.9		4	3.7	4.3		4.9	
58	11	7.7	8	8	4.9	6	4	2.3	4.3	4.3	3.2	4.1
59	7	8	8	7	7.1	9.1	3	2.3	4.3	5.3	2.3	3.6
60	13	4.7	11	7	11	8.5	3	3	4	9	9.2	4.2
61	13	**26**	9.3	7.3	8.2	7.1	4.5	1	4	3.3	4.4	5.1
62	5	20	9.3	10	6.3	4.6	16	5.3	6.7	10	4.7	8.7
63	**27**	17	6	11	6	6.7	18	10	3.7	20	6	5.8
64	20	**31**	7	7	6.5	7.2	14	8.7	4.7	4.3	2.6	4.2
65	7	10	6.7	7.3	8.9	8	19	6.3	5.3	6.7	5	7.4
66	11	17	5.7	10	4		8	2.3	4.3	5.7	5.1	
67	12	9.7	11	6	8.1	8.8	5	3	2.3	4.3	6.8	4.7
68	11	7	7	7		5.2	5.5	4	5.3	3.7		4.6
69	10	7.3	8.7	6	4.6	7.2	5	3	3.3	4	3.1	5
70	12	7	7.3	7.3	4.6	7	3.5	2	3.3	5	3.3	2.2

Table 19: Copper Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71	11	**59**	7	7	5.6		4.5	3.7	8.7	5.7	4.3	
72	**76**	18	**44**	**33**		18	9	**34**	**36**	**45**	**48**	**22**
73	**26**	12	14	14		11	**22**	**41**	11	**44**		8.9
74	18	10	20		6.2	10	3	12	7.7		16	9.6
75		16	9		6.5	6.7	3	8	5		4.8	4.7
76		16	9	13				16	9	9		
77	20	10	9.7	9.3	6.9	7.4	11	4	4.6	6.7	6.7	5.7
78	19	15	8.2	9.7		5.5	4	4.7	5	9.3		4.4
79	15	14	5.1	9.3			2	6.7	6.8	14		
80	20	15	12	7	9.5	8.9	10	12	9.3	9.3	8.8	5.6
81	20	15	20	12	6	8.8	7	4.3	7.7	8.3	5.4	5.9
82	**70**		12	9.7	14	6.8	9	4.7	5.3	8	5.9	14
83	**89**	**34**		**60**	13		**76**		14	**25**	**36**	
84	**60**	**33**	17	11			**38**	**31**	**26**	16		
85	20	18	16	12	10		10	**21**	11	8.3	4.6	
86	**27**	**68**	12	11	8.3		10	9	9.3	6.7	4.3	
87		**81**	**47**	**38**	13	9.5	**43**	**28**	**52**	**86**	15	**26**
88		**52**		**44**		14	8	**54**	**24**	**45**	**21**	12
89	**50**		**30**	**21**	14	5.5	16	19	**22**	15	9.9	8.7
90	**25**	13	10		9.5	9.3	8	**49**	5.7		9	9.8
91	11	12	15	12	7.1	5.7	9.5	4.3	4	5.7	4.5	6.3
92	12	6.7	13	8.7	7.8		7	3.7	3	11	8.1	
93	20	5	10	9.3	7.5	11	7	2.3	6.3	5.7	6.4	6.5
94	8	5.3	8.7	8	6.8	7.9	2	1.3	7	16	5.7	5.6
95	8	**360**	8	7.3	7.9	9.5	3	2	3.3	6.7	4.7	4.5
96	**31**	**54**	**110**	**66**	**39**	14	**91**	**220**	**22**	**37**	**78**	**35**
97	13	**33**	**32**	**70**	11	13	10	**45**	10	**24**	15	**110**
98	18	18	19	**22**	8.2	8.2		9	**26**	12	**43**	15
99	**21**	17	20	13	8.3	7.9	13	12	**33**	6.7	**22**	3.2
100	12	7.7	15	15	5.7	8.2	3	10	7	10	11	5.8
101	14	9.7	11	17	4	5.8	11	8	5.3	19	13	8
102	16	9.7	14	8	5.9	5	2	2	7.3	9.3	3.1	4.4
103	13	8	12	12	5.5	6.2	3.5	2	4.3	8.7	2.4	3
104	10	8.3	12	7.7	5.4	7.6	1	2.3	3.7	7.7	2.9	3.5
105	11		7.7	6.7	6.1	11	5	3.3	2.7	4.3	4.2	4.1
106		**30**	**40**	**62**	10	8.3			**25**	**92**	13	**22**
107	7	**54**	**140**	**33**		17	4	**35**	**74**	19		14
108	17	**31**	20		14	14	8	**38**	8.5		**28**	13
109	11	**26**	16		11	11	15	**23**	7		16	7.2
110	17	19	18				7	18	11		8.4	
111	17	**23**	13		16	6.2	10	13	16		15	4.7
112	11	8.7	12		9.7	7.4	4	3	5		5	6
113	15	12	14		9.4	8.4	3	1.7	7.3		4	7.5
114	15		**45**	6	7.5		18	2	**23**	5	9.2	

* - 1971 Aspen foliage was washed.

Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.

Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 20 ug/g Cu for foliage and 20 ug/g for forage.

Table 20: Iron Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**525**	360	210	160	91		**580**	350	180	110	110	
23	**565**	370	380	130	87			190	200	71	130	
24	**560**	**520**	210	190	91		135	260	170	93	270	
25	30	93	90	51	46		180	57	170	64	61	
26	37	230	76	120			400	130	120	69	80	
27	160	120	110	240	32	110	45	100	200	130	57	160
28	120	83	52		48		45	180	120		160	
29				220		140		**1500**	**630**	120	150	90
30			250	150	120	320	**580**	**590**	350	230	290	330
31	**960**	**670**	200			150	393	480	270		250	330
32	**815**	450	**520**	120	71		256	440	280	210	200	
33	380	110	130	90	100	350	125	60	180	69	85	360
34	**810**	190	50	110	43	52	141	59	150	53	93	49
35	235	110	33	97	63	92	75	180	100	83	110	150
36		130	270	180	120			180	200	200	120	
37			430		100			110	200		54	
38	286	110	90		110		259	66	220		210	
39	282	81	65			74	145	84	130		160	160
40	**703**	190	190		99		142	130	170		130	
41	**509**	190	180		66		401	160	200		78	
42	228	120	150		68		147	110	180			
43	408	73	130	91	140	73	125	85	170	130	200	46
44		400	320	130		150	275	310	250	170	140	65
45	460	310	150	310	110		360	330	310	130	130	
46	**540**	190	150		95	70	200	130	150		56	70
47		120						180				
48	272	270	160	120	110	65	421	110	150	130	96	49
49	**560**	160	100	68	140	59	85	200	150	130	130	57
50	400	120	75		64	65	55	94	83		130	74
51	320	150	140				105	87	87			
52	**520**	100	150	120	63	72	210	180	140	84	120	80
53	403	160	83	99	72		75	170	220	50	39	
54	440	160	120			110	140	77	300			80
55	**630**	260	50		52	48	210	210	130			29
56	140	110	68		74		73	87	220		81	
57	100	78	87		150		95	39	85		160	
58	365	76	130	110	71	58	113	35	63	72	44	35
59	135	95	**640**	58	120	93	72	52	390	43	37	41
60	105	93	160	41	69	55	6	140	83	60	69	52
61	86	390	160	57	44	56	49	77	160	46	55	48
62	52	340	120	120	180	51	265	180	150	93	180	510
63	423	310	160	150	100	130	211	150	160	130	260	81
64	301	**850**	130	55	73	55	160	110	110	26	57	43
65	192	160	280	59	250	64	347	**590**	200	36	140	300
66	185	230	180	59	170		155	90	130	38	70	
67	165	84	180	66	47	60	195	140	180	61	41	48
68	108	110	91	76		78	75	75	93	23		51
69	123	62	270	92	200	230	121	73	170	90	230	**950**
70	117	57	160	44	51	49	60	35	160	31	38	30

Table 20: Iron Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71	102	460	57	60	62		51	40	73	56	71	
72	**1080**	160	370	97		68	113	250	360	120	270	100
73	440	100	160	87		84	250	210	140	220		85
74	295	64	190		59	56	90	110	120		62	56
75		290	85		45	42	107	71	150		46	30
76		210	150	370				220	180	82		
77	270	120	460	100	59	57	110	90	200	50	42	42
78	200	120	88	69		42	75	92	90	44		45
79	213	100	100	90			73	85	300	87		
80	**555**	210	150	71	63	88	11	170	180	67	90	120
81	**940**	170	170	110	69	65	93	160	300	49	43	32
82	**1650**		230	120	75	70	164	78	200	92	57	49
83	**1760**	450		**2300**	200		**1850**		440	**980**	220	
84	**605**	330	270	120			**805**	360	390	170		
85	161	160	240	100	93		145	160	320	36	78	
86	217	**800**	69	62	110		136	97	230	37	51	
87		**1100**	430	320	210	97	**700**	340	**670**	280	150	190
88		400		400		220	175	480	430	480	230	72
89	450		250	190	110	61	340	200	290	120	83	66
90	360	150	110		69	260	130	420	**610**		48	230
91	140	360	220	88	54	74	110	150	150	78	50	52
92	500	170	120	61	46		132	180	140	91	67	
93	**660**	**610**	140	72	100	91	110	55	67	48	78	67
94	160	**1500**	180	140	280	170	82	320	140	470	470	190
95	485	460	41	58	**590**	64	**1200**	**930**	40	240	**850**	66
96	175	360	**610**	140	160	71	250	**710**	390	170	150	70
97	200	**950**	380	460	150	120	236	330	190	170	190	370
98	**685**	320	**710**	**760**	64	71		220	**810**	400	320	130
99	**505**	290	**780**	**650**	58	150	160	320	**2000**	350	**580**	82
100	210	130	**550**	230	74	80	140	140	330	110	130	66
101	390	90	240	280	140	47	115	81	130	390	120	51
102	125	160	230	78	69	46	50	59	270	88	53	36
103	160	100	80	73	77	40	55	55	41	83	41	21
104	90	220	110	110	63	50	44	75	82	81	140	35
105	110		100	140	64	69	75	210	150	240	76	220
106		**870**	210	170	69	45			110	180	93	69
107	**577**	480	300	150		75	65	**600**	**1100**	180		57
108	239	21	110		65	120	140	470	130		130	58
109	91	170	82		57	85	137	18	80		83	160
110	5	140	83				120	170	110		130	
111	169	120	120		68	42	213	110	180		100	50
112	157	77	150		56	79	190	64	100		51	110
113	330	72	140		88	100	52	67	92		42	160
114	170		**5500**	41	86		250	47	**3200**	34	310	

* - 1971 Aspen foliage was washed.

Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.

Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 500 ug/g Fe for foliage and 500 ug/g for forage.

Table 21: Nickel Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**85**	**170**	**69**	**87**	**59**		**50**	**76**	10	5.3	**34**	
23	**67**	**110**	**130**	22	**32**			**40**	**53**	7.3	11	
24	**225**	**150**	**170**	**33**	**46**		**34**	**57**	17	20	**28**	
25	**58**	**140**	**45**	**46**	**69**		25	**27**	23	20	16	
26	**130**	**180**	**180**	**76**			**32**	**28**	**28**	8	21	
27	**62**	**65**	**130**	**110**	**56**	**75**	17	**29**	**42**	**30**	14	18
28	**35**	**66**	**48**		**35**		8	22	9		3.2	
29				26		30		**120**	**40**	17	18	14
30			**62**	**47**	**76**	**41**	**38**	**100**	22	**27**	21	15
31	**90**	**110**	**90**			**66**	**31**	**59**	**46**		22	21
32	**68**	**93**	**48**	**71**	23		**31**	**58**	**27**	**29**	18	
33	**91**	**150**	**68**	21	**58**	**57**	18	22	19	3.3	14	**27**
34	**157**	**180**	12	**54**	**53**	**81**	**29**	22	16	**29**	21	15
35	**72**	**100**	**120**	**65**	**83**	**57**	7	**31**	12	8	17	4.4
36		**97**	**60**	**73**	**46**			**42**	17	15	**120**	
37			**53**		**37**			11	6.3		9.2	
38	**65**	**73**	**66**		**43**		**32**	24	**29**		**47**	
39	**96**	**86**	**93**			**52**	**40**	**28**	**48**		**27**	17
40	**93**	**120**	**56**		**38**		**49**	**29**	**28**		17	
41	**75**	**96**	**110**		**34**		**47**	20	6		4.1	
42	**155**	**140**	**110**		**42**		**31**	25	25			
43	**202**	**100**	**67**	**66**	20	**42**	**43**	**36**	16	6.3	**26**	**46**
44		**160**	**79**	**91**		**47**	**41**	**110**	**42**	25	**36**	12
45	**79**	**98**	**120**	**64**	**80**		**40**	**100**	**73**	23	**49**	
46	**170**	**260**	**200**		**96**	**160**	**39**	**47**	**27**		24	**35**
47		**93**						**40**				
48	**68**	**50**	**68**	**56**	**150**	**87**	**59**	**170**	18	16	**83**	10
49	**270**	**130**	**79**	**58**	**63**	**50**	16	**140**	**47**	13	**39**	6.8
50	**130**	**110**	**98**		**72**	**58**	23	**28**	**30**		**35**	**49**
51	**74**	**68**	**49**				**36**	25	**27**			
52	**120**	**65**	**77**	**58**	**68**	**100**	18	**78**	**90**	**39**	**36**	**63**
53	**160**	**53**	**66**	**37**	**62**		11	**57**	**34**	**31**	19	
54	**214**	**92**	**72**			**140**	**58**	**47**	**50**			**56**
55	**142**	**62**	**75**		**64**	**170**	**134**	**35**	**44**			**28**
56	**45**	**64**	**81**		**68**		**42**	**28**	10		**29**	
57	**50**	27	**75**		**83**		**43**	**30**	13		9.1	
58	**64**	25	**130**	28	**59**	**79**	24	20	11	8	3.5	20
59	**51**	**60**	30	20	**34**	19	9	12	5	4.7	2.4	4.1
60	**55**	24	13	28	25	**40**	10	12	5	5.3	5.6	20
61	**36**	**87**	11	11	16	23	11	8	5	3.3	5.6	5.1
62	**55**	**89**	**56**	**33**	**37**	**64**	**48**	**85**	**50**	**31**	15	**29**
63	**105**	**170**	**110**	**49**	**74**	**130**	**105**	**80**	**50**	**54**	**44**	**53**
64	**80**	**340**	**130**	**120**	**140**	**120**	**90**	**53**	**53**	3.3	12	**32**
65	**55**	**190**	**200**	**46**	**80**	**78**	**105**	**65**	**87**	**59**	**27**	15
66	**165**	**210**	**77**	**77**	**190**		**67**	**53**	**32**	8.7	**52**	
67	**90**	**100**	**93**	**66**	**87**	**84**	**39**	25	14	20	15	8.2
68	**74**	21	**43**	13		12	23	22	3.7	3		7.6
69	27	9	11	12	10	9.4	11	7.3	8.3	7.7	2.5	4.6
70	9	16	22	7	9.3	16	3	3	7.7	1	3.7	1.9

Table 21: Nickel Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71	11	**92**	8	23	2.2		1	4.3	4.3	1.7	1.3	
72	**84**	**78**	**82**	**54**		**130**	24	**53**	**77**	**30**	**79**	**51**
73	**160**	**120**	**89**	**94**		26	4	**47**	8.3	**46**		10
74	**175**	**63**	**120**		**49**	**62**	**31**	**41**	8		**110**	**38**
75		**99**	**120**		**69**	**33**	**36**	**30**	17		21	21
76		**120**	**46**	**69**				**32**	16	**35**		
77	22	**51**	**99**	**65**	**49**	**35**	**32**	**42**	21	**35**	**55**	16
78	**180**	**120**	15	**87**		25	**20**	24	14	7		13
79	**200**	**130**	**31**	**110**			**31**	24	**220**	**49**		
80	**207**	**100**	**120**	**130**	**110**	**120**	**47**	**29**	**71**	**29**	**40**	9.8
81	**162**	**110**	**39**	**200**	**93**	**150**	19	**29**	21	18	14	3.5
82	**253**		**160**	**80**	**76**	**63**	**45**	**43**	**77**	13	9.6	**110**
83	**165**	**120**		**100**	**82**		**62**	-	**43**	24	**48**	
84	**108**	**70**	**57**	**70**			**108**	**60**	**49**	13		
85	**172**	**100**	**72**	21	**46**		**37**	18	**74**	8	12	
86	**59**	**230**	**130**	**83**	**60**		21	8.7	18	2.3	6.8	
87		**290**	**89**	**200**	**120**	**180**	25	**88**	**160**	**80**	**95**	**69**
88		**150**		**79**		**43**	**23**	**97**	**37**	**66**	**59**	12
89	**142**		**150**	**61**	**67**	**56**	**31**	**54**	**51**	19	**27**	**35**
90	**180**	**140**	**140**		**36**	**190**	**41**	**100**	**35**		23	**54**
91	**61**	**100**	**150**	**96**	**110**	**45**	**37**	**39**	24	4	**42**	**29**
92	**95**	**75**	**30**	14	18		19	**29**	3.3	6.7	7.9	
93	**66**	26	15	**39**	19	**53**	12	**26**	2.7	19	5.4	9.4
94	20	**38**	**54**	**33**	**34**	**40**	24	19	16	20	23	8.3
95	**28**	**160**	**37**	6.7	26	30	**32**	14	4.3	2.7	6.4	9.7
96	**94**	**110**	**150**	**230**	**98**	**110**	**50**	**170**	**41**	**54**	**55**	**55**
97	**70**	**150**	**140**	**130**	**65**	**68**	**34**	**86**	**91**	**59**	**62**	**180**
98	**76**	**140**	**130**	**100**	**110**	**91**		21	**94**	**46**	**63**	**86**
99	**165**	**130**	**150**	**77**	**140**	**89**	**33**	**70**	**95**	**41**	**60**	**29**
100	**94**	**49**	**120**	**130**	**38**	**32**	**27**	**53**	12	10	6.7	18
101	**62**	**53**	**68**	**49**	**110**	**96**	4	11	4.7	**27**	**28**	**25**
102	**32**	**36**	**74**	6.7	25	21	1	17	8.3	22	8.3	20
103	**31**	22	**35**	**31**	16	20	12	3	7.7	4.3	5.8	3
104	13	20	20	10	17	13	10	9	7.3	10	5.4	12
105	11		11	**5.3**	14	13	7	6.7	11	3	5.7	1.9
106		**120**	**75**	**120**	**58**	**60**			21	**52**	**50**	**41**
107	**80**	**230**	**130**	**63**		**46**	**40**	**240**	**130**	21		14
108	**160**	**190**	**220**		**120**	**32**	**73**	**89**	24		**66**	**48**
109	**55**	**150**	**78**		**120**	**120**	**69**	**68**	8.3		25	23
110	**165**	**220**	**110**				**38**	**41**	23		8.4	
111	**155**	**170**	**110**		**94**	**86**	**36**	**38**	**53**		**32**	**32**
112	**91**	**180**	**130**		**110**	**80**	**30**	**52**	18		23	**28**
113	**40**	**34**	7.7		10	17	7	22	1		3	3.5
114	6		20	10	16		**37**	9.3	13	7.3	7.7	

* - 1971 Aspen foliage was washed.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 30 ug/g Ni for foliage and 25 ug/g for forage.

Table 22: Selenium Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22		**0.78**	<0.3	**0.48**	**0.46**			**0.53**	<0.3	0.18	<0.2	
23		**0.84**	<0.3	0.18	**0.52**			**0.78**	<0.3	0.3	<0.2	
24		**0.91**	<0.3	0.33	0.29			**0.79**	<0.3	0.25	**0.58**	
25		**0.75**	<0.3	0.4	<0.2			0.3	<0.3	0.17	0.3	
26		**1.3**	<0.3	**0.54**				**0.6**	<0.3	0.1	0.29	
27		**1.2**	<0.3	<0.03	<0.2	<0.2		0.46	<0.3	0.18	<0.2	<0.2
28		**0.71**	<0.3		<0.2			0.36	<0.3		<0.2	
29				0.37		0.25		**0.81**	<0.3	0.36	0.34	<0.2
30			<0.3	0.35	<0.2	<0.2		0.49	<0.3	0.43	0.36	<0.2
31		**0.82**	<0.3			0.35		**0.76**	<0.3		0.36	0.3
32		**1.8**	<0.3	0.06	0.33			**0.57**	<0.3	0.23	0.32	
33		**0.9**	<0.3	0.21	**0.54**	<0.2		0.34	<0.3	<0.03	<0.2	<0.2
34		**0.82**	0.37	0.11	0.26	<0.2		0.33	0.33	<0.03	<0.2	<0.2
35		0.28	<0.3	0.08	<0.2	<0.2		0.18	<0.3	0.04	<0.2	<0.2
36		**0.67**	<0.3	**0.62**	**0.54**			**0.55**	<0.3	0.3	0.27	
37			0.43		0.49			0.29	<0.3		0.25	
38		0.49	<0.3		0.48			0.32	<0.3		**0.7**	
39		**0.9**	<0.3			<0.2		0.27	<0.3		0.35	<0.2
40		**0.78**	<0.3		**0.7**			**0.5**	<0.3		0.21	
41		**0.86**	<0.3		0.33			0.42	<0.3		0.31	
42		**0.71**	0.33		0.21			0.42	<0.3			
43		**0.74**	0.33	0.33	**0.54**	0.25		0.43	**0.53**	0.08	0.27	<0.2
44		**1.3**	<0.3	0.41		0.5		**0.56**	<0.3	0.43	0.28	<0.2
45		**1.3**	<0.3	0.47	0.49			**0.59**	<0.3	0.28	0.37	
46		**0.55**	<0.3		0.43	<0.2		0.42	<0.3		0.31	0.3
47		0.34						**0.6**				
48		**0.58**	<0.3	0.38	0.47	<0.2		0.33	<0.3	0.16	0.26	<0.2
49		0.39	<0.3	0.31	0.32	0.45		**0.53**	<0.3	0.23	0.23	<0.2
50		**0.67**	<0.3		0.29	<0.2		**0.71**	<0.3		0.34	<0.2
51		**0.7**	0.4					0.38	<0.3			
52		**0.64**	<0.3	0.42	0.26	0.3		0.48	<0.3	0.31	0.43	<0.2
53		0.46	<0.3	0.45	0.34			0.45	<0.3	0.39	0.26	
54		0.31	<0.3			<0.2		0.25	<0.3			<0.2
55		0.33	<0.3		<0.2	<0.2		**0.59**	<0.3			<0.2
56		0.38	<0.3		0.22			0.25	<0.3		0.28	
57		0.47	<0.3		<0.2			0.22	<0.3		<0.2	
58		0.16	<0.3	0.12	<0.2	<0.2		0.17	<0.3	0.15	<0.2	<0.2
59		0.37	<0.3	0.12	<0.2	<0.2		0.18	<0.3	0.1	<0.2	<0.2
60		0.19	<0.3	<0.03	<0.2	<0.2		0.19	<0.3	<0.03	<0.2	<0.2
61		**0.89**	<0.3	<0.03	<0.2	<0.2		0.16	<0.3	<0.03	<0.2	<0.2
62		**0.84**	<0.3	0.16	<0.2	<0.2		0.2	<0.3	0.07	0.3	<0.2
63		**0.74**	<0.3	0.11	0.48	0.3		0.47	<0.3	0.27	0.37	<0.2
64		**0.61**	<0.3	<0.03	0.24	<0.2		0.34	<0.3	<0.03	<0.2	<0.2
65		0.28	<0.3	0.25	0.22	<0.2		0.26	<0.3	<0.03	<0.2	<0.2
66		0.4	<0.3	<0.03	<0.2			0.18	<0.3	<0.03	<0.2	
67		0.26	<0.3	<0.03	<0.2	<0.2		0.22	<0.3	<0.03	<0.2	<0.2
68		0.17	<0.3	<0.03		<0.2		0.25	<0.3	<0.03		<0.2
69		0.17	<0.3	0.07	<0.2	<0.2		0.16	<0.3	<0.03	<0.2	<0.2
70		0.18	<0.3	<0.03	<0.2	<0.2		0.08	<0.3	<0.03	<0.2	<0.2

Table 22: Selenium Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71		**5.3**	<0.3	<0.03	<0.2			0.11	<0.3	<0.03	<0.2	
72		**1.4**	**1.7**	**4.5**		**4.3**		**1.1**	<0.3	**0.51**	**2.5**	**2.2**
73		**0.66**	<0.3	0.42		**1.2**		**1.5**	<0.3	**0.93**		0.35
74		**0.83**	<0.3		**0.53**	0.4		0.42	<0.3		**0.62**	0.3
75		**0.62**	0.35		0.46	**0.6**		**0.74**	<0.3		0.4	0.35
76		**0.86**	<0.3	0.3				0.49	<0.3	0.13		
77		**0.64**	<0.3	0.2	0.37	**0.65**		0.34	<0.3	0.14	0.21	<0.2
78		**0.53**	<0.3	0.16		0.3		0.32	<0.3	0.09		<0.2
79		**0.61**	<0.3	0.22				0.26	<0.3	0.08		
80		**1**	<0.3	0.14	**0.59**	<0.2		**0.65**	<0.3	0.18	0.31	<0.2
81		**0.52**	<0.3	0.34	0.29	<0.2		0.37	<0.3	0.11	<0.2	<0.2
82			<0.3	0.37	<0.2	0.3		0.34	<0.3	0.13	<0.2	0.3
83		**2**		**1.3**	**1.4**				**0.63**	0.37	**1.6**	
84		**1.7**	<0.3	0.39				**1.3**	<0.3	0.17		
85		**0.82**	0.4	0.49	<0.2			**0.72**	<0.3	0.11	0.22	
86		**3.5**	<0.3	0.17	<0.2			0.47	0.33	0.07	<0.2	
87		**2.1**	<0.3	**0.93**	**1.5**	**1.2**		**0.78**	0.37	**1.1**	0.48	**0.8**
88		**1.7**		**1.7**		0.75		**1.4**	<0.3	**0.57**	**1.1**	0.3
89			<0.3	**0.58**	**0.97**	0.25		**1.6**	<0.3	**0.69**	0.37	0.4
90		**0.69**	<0.3		**1.5**	<0.2		**2.5**	<0.3		**0.91**	<0.2
91		**0.56**	<0.3	**0.78**	<0.2	<0.2		0.41	<0.3	0.14	<0.2	<0.2
92		0.42	<0.3	0.29	0.33			0.24	<0.3	0.2	0.22	
93		0.2	<0.3	0.17	0.3	<0.2		0.18	<0.3	<0.03	<0.2	<0.2
94		**0.51**	<0.3	0.22	<0.2	0.25		0.2	<0.3	0.11	0.27	<0.2
95			<0.3	0.17	0.22	<0.2		0.17	<0.3	0.12	0.22	<0.2
96		**2.5**	**0.93**	**2.3**	**3.1**	**1.5**			<0.3	**33**	**1.4**	**1.2**
97		**2**	<0.3	**2.9**	**1.6**	**0.7**		**2.8**	<0.3	**1**	**0.98**	**3.2**
98		**1.3**	<0.3	**1.1**	**0.58**	0.35		**0.59**	<0.3	0.5	**1.5**	**0.75**
99		**1.4**	<0.3	**1.1**	0.36	0.25		**0.75**	<0.3	0.37	**1.2**	0.4
100		**0.75**	<0.3	0.39	0.21	0.25		0.45	<0.3	0.15	0.21	0.25
101		0.31	<0.3	**0.68**	<0.2	<0.2		0.39	<0.3	0.25	<0.2	0.25
102		0.21	<0.3	0.17	<0.2	<0.2		0.16	<0.3	0.28	<0.2	<0.2
103		0.22	<0.3	0.37	<0.2	<0.2		0.16	<0.3	0.07	<0.2	<0.2
104		0.13	<0.3	0.09	<0.2	<0.2		0.2	<0.3	0.09	<0.2	<0.2
105			<0.3	0.08	<0.2	<0.2		0.13	<0.3	0.04	<0.2	<0.2
106		**1.4**	**1.7**	**2.7**	**2.3**	**4.8**			<0.3	**2**	**0.74**	**0.95**
107		**4**	**0.53**	**2.1**		**3**		**4.1**	**0.9**	0.35		**0.95**
108		**1.1**	<0.3		**0.53**	**1.2**		**2.6**	<0.3		**0.78**	**0.6**
109		**0.84**	<0.3		0.35	0.25		**0.84**	<0.3		**0.56**	<0.2
110		**1.1**	<0.3					**0.92**	<0.3		0.23	
111		**1.1**	<0.3		**0.6**	<0.2		**1.4**	<0.3		**0.57**	<0.2
112		0.41	<0.3		0.23	<0.2		0.45	<0.3		<0.2	<0.2
113		0.32	<0.3		<0.2	<0.2		0.37	<0.3		<0.2	<0.2
114			<0.3	0.12	<0.2			0.12	<0.3	0.09	<0.2	

* - 1971 Aspen foliage was washed.
Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.
Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 0.5 ug/g Se for foliage and 0.5 ug/g for forage.

Table 23: Sulphur Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	**0.53**	**0.65**	0.3	0.22	0.18		**0.62**	0.42	0.4	0.23	0.14	
23	**0.53**	**0.47**	0.3	0.2	0.18		0.49	0.17	0.2	0.13	0.35	
24	**0.72**	0.31	0.35	0.17	0.21		0.31	0.12	0.15	0.2	0.14	
25	**0.54**	0.32	0.2	0.23	0.16		0.29	0.13	0.17	0.16	0.11	
26	**0.52**	**0.41**	0.15	0.17			0.27	0.14	0.2	0.14	0.09	
27	**0.52**	0.39	0.33	0.22	0.14	0.21	0.33	0.17	0.1	0.21	0.08	0.11
28	**0.45**	**0.42**	0.27		0.17		0.26	0.31	0.13		0.14	
29				0.27		0.19		0.37	0.2	0.11	0.12	0.12
30			**0.47**	0.21	0.19	0.21	0.48	0.36	0.17	0.12	0.17	0.28
31	**0.62**	**0.73**	0.3			0.19	0.32	0.24	0.2		0.12	0.15
32	**0.52**	**0.52**	0.3	0.2	0.28		0.33	0.16	0.1	0.21	0.09	
33	**0.6**	0.29	0.3	0.26	0.24	0.3	0.3	0.09	0.1	0.25	0.12	0.09
34	**0.59**	0.37	0.2	0.19	0.2	0.23	0.3	0.11	0.1	0.19	0.07	0.19
35	**0.44**	0.27	0.3	0.22	0.19	0.2	0.33	0.21	0.13	0.21	0.15	0.11
36		**1.1**	0.33	0.25	0.27			0.14	0.33	0.45	0.25	
37			0.3		0.15			0.14	0.1		0.08	
38	**0.72**	**0.41**	0.3		0.17		**0.74**	0.25	0.1		0.1	
39	**0.49**	**0.41**	0.23			0.16	0.29	0.23	0.1		0.07	0.07
40	**0.48**	0.35	0.27		0.15		0.36	0.17	0.23		0.09	
41	**0.59**	**0.48**	0.2		0.14		0.4	0.13	0.2		0.08	
42	**0.58**	**0.47**	0.23		0.16		0.39	0.21	0.13			
43	**0.54**	**0.48**	0.2	0.2	0.13	0.12	0.39	0.22	0.1	0.21	0.18	0.16
44		**0.76**	0.37	**0.52**		0.26	0.33	0.48	0.27	0.32	0.15	0.1
45	**0.65**	**0.5**	0.37	0.17	0.31		**0.57**	0.23	0.2	0.14	0.17	
46	**0.6**	**0.47**	0.35		0.24	0.19	0.5	0.18	0.2		0.23	0.15
47		**0.63**						0.16				
48	**1**	0.35	0.23	0.21	0.15	0.18	0.32	0.22	0.1	0.12	0.09	0.11
49	**0.52**	0.38	0.2	**0.46**	0.14	0.17	0.23	0.1	0.2	0.15	0.15	0.19
50	**0.51**	**0.41**	0.2		0.15	0.15	0.24	0.15	0.1		0.14	0.23
51	**0.62**	0.3	0.2				0.49	0.15	0.2			
52	**0.65**	0.22	0.3	0.25	0.2	0.18	0.22	0.22	0.2	0.16	0.11	0.23
53	**0.98**	0.22	0.2	0.22	0.19		0.35	0.13	0.1	0.15	0.1	
54	0.34	0.17	0.2			0.2	0.28	0.05	0.2			0.14
55	0.36	0.25	0.2		0.21	0.17	0.32	0.06	0.13			0.09
56	**0.46**	0.23	0.2		0.18		0.28	0.17	0.1		0.18	
57	0.39	0.17	0.2		0.33		0.23	0.13	0.23		0.13	
58	**0.43**	0.21	0.2	0.12	0.15	0.15	0.28	0.08	0.1	0.13	0.13	0.13
59	0.32	0.29	0.2	0.19	0.2	0.27	0.22	0.14	0.2	0.12	0.09	0.13
60	0.32	0.2	0.27	0.13	0.2	0.18	0.18	0.15	0.2	0.12	0.14	0.11
61	0.24	0.36	0.2	0.16	0.17	0.17	0.21	0.09	0.1	0.11	0.16	0.12
62	**0.67**	**0.44**	0.27	0.15	0.15	0.17	0.3	0.27	0.2	0.16	0.11	0.15
63	**0.56**	**0.44**	0.23	0.18	0.13	0.17	**0.51**	0.22	0.1	0.19	0.1	0.13
64	**0.43**	**0.42**	0.27	0.17	0.13	0.15	0.29	0.27	0.27	0.12	0.09	0.29
65	**0.5**	0.37	0.2	0.13	0.16	0.15	0.39	0.16	0.2	0.17	0.11	0.12
66	**0.43**	**0.47**	0.2	0.18	0.14		0.29	0.24	0.1	0.16	0.18	
67	0.4	0.25	0.2	0.16	0.18	0.19	0.4	0.14	0.2	0.18	0.14	0.12
68	0.39	0.15	0.23	0.18		0.16	0.14	0.08	0.2	0.13		0.15
69	0.24	0.16	0.2	0.11	0.11	0.14	0.31	0.17	0.23	0.13	0.11	0.13
70	0.31	0.18	0.2	0.15	0.26	0.17	0.17	0.05	0.1	0.12	0.13	0.09

Table 23: Sulphur Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71	0.3	0.35	0.2	0.16	0.13		0.19	0.12	0.37	0.1	0.13	
72	**0.69**	0.22	0.3	**0.66**		0.2	0.18	0.08	0.13	0.22	0.11	0.12
73	**0.5**	0.2	0.2	0.28		0.15	0.28	0.1	0.1	0.15		0.24
74	**0.47**	0.21	0.2		0.22	0.19		0.09	0.17		0.22	0.13
75		0.27	0.2		0.18	0.16	0.26	0.06	0.2		0.13	0.16
76		0.24	0.2	0.21				0.08	0.33	0.16		
77	**0.6**	0.2	0.3	0.24	0.2	0.17	**0.51**	0.12	0.15	0.19	0.22	0.12
78	0.38	0.32	0.2	0.13		0.14	0.27	0.07	0.1	0.16		0.14
79	**0.45**	0.29	0.1	0.2			0.2	0.11	0.2	0.16		
80	0.36	0.34	0.2	0.22	0.18	0.17	0.19	0.14	0.2	0.18	0.16	0.1
81	**0.52**	**0.42**	0.2	0.21	0.13	0.23	0.49	0.08	0.2	0.16	0.11	0.15
82	**0.89**		0.3	0.21	0.21	0.17	0.49	0.13	0.17	0.21	0.12	0.29
83	**0.78**	**0.48**		0.28	0.16		**0.55**	-	0.13	0.28	0.1	
84	**0.54**	0.34	0.2	0.15			0.4	0.24	0.2	0.19		
85	**0.51**	**0.53**	0.3	0.23	0.18		0.28	0.18	0.1	0.17	0.14	
86	**0.78**	**0.41**	0.27	0.22	0.2		0.26	0.19	0.1	0.23	0.17	
87		**0.51**	0.23	0.24	0.21	0.2	**0.57**	0.22	0.2	0.15	0.11	0.17
88		0.33		0.25		0.15	0.16	0.28	0.1	0.13	0.08	0.08
89	0.4		0.23	0.16	0.18	0.12	0.33	0.09	0.2	0.16	0.07	0.2
90	0.26	0.38	0.2		0.14	0.17	0.18	0.11	0.2		0.15	0.11
91	0.37	0.22	0.2	0.22	0.18	0.17		0.08	0.1	0.17	0.12	0.12
92		0.23	0.2	0.18	0.15			0.21	0.2	0.21	0.27	
93	0.29	0.28	0.17	0.16	0.21	0.2	0.36	0.13	0.1	0.16	0.15	0.17
94	0.19	0.24	0.23	0.19	0.2	0.18	0.13	0.18	0.13	0.25	0.11	0.15
95	**0.41**	**1.2**	0.2	0.17	0.19	0.19	0.14	0.22	0.1	0.16	0.12	0.13
96	**0.72**	**0.8**	0.3	0.36	**0.63**	0.19	0.38	0.29	0.2	0.24	0.1	0.1
97	**0.88**	0.4	0.27	0.25	0.14	0.13	0.29	0.17	0.23	0.33	0.18	0.19
98	0.36	**0.41**	0.2	0.24	0.29	0.2		0.19	0.23	0.33	0.09	0.29
99	**0.41**	**0.46**	0.33	0.31	0.22	0.2	0.14	0.32	0.2	0.22	0.12	0.14
100	0.24	**0.41**	0.23	0.2	0.15	0.13	0.14	0.18	0.1	0.2	0.06	0.12
101	0.24	0.27	0.33	0.23	0.16	0.16	0.23	0.27	0.17	0.19	0.1	0.08
102	0.27	0.27	0.2	0.26	0.12	0.11	0.26	0.22	0.17	0.18	0.14	0.12
103	0.27	0.21	0.2	0.22	0.14	0.15	0.1	0.22	0.1	0.26	0.1	0.09
104	0.23	0.19	0.2	0.18	0.14	0.17	0.1	0.18	0.13	0.16	0.08	0.16
105	0.28		0.1	0.17	0.12	0.18	0.24	0.13	0.17	0.11	0.09	0.13
106		0.19	0.2	0.26	0.16	0.22			0.1	0.15	0.11	0.13
107	**0.85**	**0.52**	0.27	0.22		0.11	0.49	0.42	0.23	0.07		0.07
108	**0.46**	0.37	0.2		0.15	0.15	0.38	0.16	0.1		0.14	0.13
109	0.39	0.32	0.2		0.19	0.19	0.27	0.19	0.1		0.12	0.11
110	**0.49**	0.35	0.2				0.3	0.16	0.1		0.15	
111	0.37	0.29	0.2		0.14	0.15	0.31	0.2	0.2		0.17	0.13
112	**0.48**	0.27	0.27		0.19	0.16	0.39	0.2	0.13		0.1	0.15
113	0.38	0.22	0.2		0.19	0.18	0.18	0.16	0.23		0.16	0.22
114	0.29		0.23	0.12	0.2		0.25	0.13	0.13	0.11	0.27	

* - 1971 Aspen foliage was washed.

Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.

Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 0.4% S for foliage and 0.5% S for forage.

Table 24: Zinc Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
22	66	190	120	74	120		25	22	20	17	17	
23	30	61	110	23	44			19	35	27	24	
24	38	41	81	18	32		6	21	20	17	21	
25	95	100	90	49	100		12	12	18	28	11	
26	10	160	50	120			6	3	16	14	17	
27	100	78	100	52	61	130	12	13	15	25	24	14
28	65	110	160		140		10	22	34		25	
29				24		45		62	36	10	9.7	10
30			65	45	40	53	9	5.7	28	19	11	15
31	200	32	80			36	13	25	23		22	27
32	98	43	49	48	41		45	42	28	18	20	
33	81	100	97	30	95	130	7	52	21	26	38	20
34	98	89	46	95	100	140	14	4	9.3	21	18	14
35	140	96	110	110	190	190	31	32	17	55	31	21
36		64	99	35	32			18	27	14	34	
37			110		44			8.3	9		9	
38	**281**	68	51		70		37	12	32		16	
39	130	**290**	140			48	13	40	32		14	8.5
40	171	65	78		45		40	31	12		19	
41	50	110	130		88		16	18	18		7.3	
42	152	150	110		130		36	22	45			
43	97	75	120	120	83	140	**107**	13	18	17	16	21
44		240	59	57		36	7	9.7	12	13	10	4.5
45	35	55	140	180	96		22	8.7	76	21	22	
46	42	78	50		59	140	9	3	16		25	32
47		130						17				
48	16	100	52	79	52	58	35	34	17	18	23	16
49	56	85	36	97	57	75	4	21	12	12	11	10
50	72	49	88		83	88	10	20	34		13	12
51	50	85	32				6	20	19			
52	20	58	83	74	50	73	6	3.7	18	16	12	16
53	58	47	49	67	180		6	14	13	14	15	
54	44	43	74			130	16	6	20			16
55	28	190	34		83	81	14	22	19			9
56	90	42	**270**		140		15	18	26		37	
57	59	120	87		78		15	17	13		14	
58	215	180	**310**	210	65	110	17	6.7	62	28	14	40
59	250	**310**	140	170	**300**	250	17	35	28	17	16	25
60	**405**	**260**	210	140	220	180	26	38	43	18	26	31
61	250	100	**270**	250	230	240	30	35	30	22	29	36
62	22	**450**	59	81	57	65	12	**160**	21	12	10	11
63	79	74	39	120	45	67	23	14	21	18	19	17
64	86	160	**260**	49	66	240	22	15	56	15	12	24
65	39	110	80	91	110	170	22	36	24	24	20	27
66	84	240	78	140	150		23	16	19	14	25	
67	94	**340**	150	68	110	180	81	12	34	25	29	16
68	130	130	180	210		190	24	45	45	20		23
69	195	250	160	130	110	190	**123**	21	34	23	16	17
70	**360**	**320**	**260**	180	110	180	24	23	42	15	14	9.5

Table 24: Zinc Concentration in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Aspen						Forage					
	1971*	1976	1981	1986	1992	1997	1971	1976	1981	1986	1992	1997
71	165	110	170	210	92		20	19	29	17	11	
72	110	63	47	100		49	7	7.3	27	11	20	14
73	140	55	85	76		190	12	14	11	29		18
74	95	81	160		62	250	14	19	13		33	32
75		150	88		75	80	14	33	34		8.3	13
76		150	150	130				40	39	42		
77	140	78	130	130	120	120	25	23	29	30	27	20
78	190	120	110	63		150	23	9	17	28		20
79	50	49	22	58			14	42	54	28		
80	48	91	53	63	65	110	40	36	23	17	20	24
81	97	53	110	73	40	150	13	21	25	18	26	24
82	155		36	28	67	44	9	14	22	17	17	21
83	112	120		67	28		28		20	30	8.7	
84	121	**330**	78	57			14	39	50	30		
85	120	180	250	130	120		32	16	24	25	15	
86	120	75	130	99	140		15	23	15	17	14	
87		110	94	210	86	78	24	38	100	33	45	44
88		82		90		77	8	19	20	20	25	26
89	64		89	70	35	90	8	21	22	11	12	21
90	71	140	100		24	140	10	19	24		9.7	20
91	85	140	140	100	81	150	43	20	16	23	10	34
92	95	170	180	180	170		24	20	25	20	15	
93	200	100	250	160	**260**	**270**	20	29	31	35	21	24
94	110	200	**270**	110	110	110	17	30	39	52	36	21
95	135	97	130	100	130	170	43	45	14	17	17	27
96	40	140	51	130	160	60	10	17	20	19	8.3	23
97	84	100	85	54	46	45	7	17	32	23	23	32
98	36	92	82	49	50	71		18	17	13	20	19
99	90	220	140	80	72	130	14	17	28	15	21	34
100	70	86	200	150	96	130	18	34	19	16	11	16
101	55	**320**	150	130	99	160	28	1.7	18	15	13	22
102	20	240	230	28	110	130	8	33	28	**210**	15	21
103	110	**270**	**350**	210	180	160	44	17	21	40	14	19
104	**280**	200	**270**	200	140	150	16	12	38	27	21	39
105	**260**		140	230	140	250	43	16	31	22	18	23
106		18	55	81	28	51			21	14	21	23
107	78	80	**290**	180		13	10	**180**	52	14		6
108	98	120	98		46	130	14	37	27		19	33
109	46	110	89		56	120	54	23	27		10	18
110	95	110	200				50	43	13		15	
111	95	140	140		61	87	34	19	14		18	14
112	62	150	110		120	110	24	23	24		18	45
113	**400**	250	**510**		220	240	24	18	37		26	31
114	50		100	170	170		61	70	22	26	39	

* - 1971 Aspen foliage was washed.

Values represent single samples collected in 1971, means of triplicate samples in 1976 and 1981 and duplicate samples in 1992 and 1997.

Concentrations shown in bold exceed the Upper Limit of Normal Guideline of 250 ug/g Zn for foliage and 100 ug/g for forage.

Table 25: Aluminum, Cadmium, and Calcium Concentrations in Vegetation

Station	Aluminum				Cadmium				Calcium							
	Aspen		Forage		Aspen		Forage		Aspen				Forage			
	1992	1997	1992	1997	1992	1997	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
22	23		16		**1.4**		<0.1		11000	16000	11000		4600	4700	1200	
23	30		36		**1.7**		<0.1		12000	5100	11000		1200	3900	4900	
24	49		69		0.13		0.22		9700	6900	3000		750	1900	1200	
25	17		14		0.87		<0.1		6600	3800	6000		810	940	1500	
26			36				<0.1		4600	7100			1300	1100	960	
27	24	91	8.7	75	0.83	**1.1**	0.11	0.25	5200	3200	4700	5600	1300	1500	1200	1600
28	22		40		**1.4**		<0.1		7700		8600		1600		2600	
29		48	38	30		0.9	0.22	0.2		5700		15000	2000	2400	2600	2700
30	29	140	110	140	0.49	**1.1**	0.39	0.3	19000	6100	4300	9600	1700	860	2700	5500
31		130	110	260		**1.2**	0.15	0.4	9200			4800	1800		1000	1300
32	31		55		0.67		0.29		6300	3500	9100		1400	1400	900	
33	56	270	12	240	**2.1**	0.85	0.19	0.45	6900	9700	6700	9200	1500	4100	1300	1900
34	16	28	14	16	0.84	**1.4**	0.11	<0.1	9700	8000	7600	13000	1200	1500	1000	2200
35	23	46	46	68	0.87	**1.7**	0.15	<0.1	11000	7700	5600	10000	1100	2300	1900	1700
36	38		31		0.31		0.2		18000	12000	10000		4000	4100	2400	
37	48		27		**1.7**		<0.1		11000		10000		3200		2500	
38	71		76		0.47		0.12		6200		8900		1400		1700	
39		48	52	64		0.8	0.11	0.2	14000			5000	1400		720	920
40	46		52		0.85		<0.1		9600		9300		1200		1200	
41	16		23		0.92		<0.1		9800		5900		2600		2900	
42	19				**1.3**				12000		7200		2500			
43	35	35	40	12	0.88	**2**	0.11	<0.1	16000	14000	8900	14000	9500	3600	2000	2000
44		64	48	17		0.5	0.11	0.15	17000	12000		15000	3800	3000	1900	2600
45	36		22		**1.9**		0.38		11000	17000	16000		1500	3000	1200	
46	24	24	9.3	17	0.91	**2.2**	0.11	0.2	7300		10000	7600	900		3700	1700
47																
48	23	16	25	15	**1.6**	**1.2**	<0.1	<0.1	7900	12000	9700	11000	2600	3200	1800	4700
49	64	22	62	19	0.89	**1.1**	<0.1	<0.1	12000	19000	6800	10000	1500	3000	1300	4800
50	24	19	56	24	**1.2**	0.95	0.11	<0.1	12000		8900	13000	1500		1300	1600
51									6300				1000			
52	19	20	45	37	<0.1	0.4	<0.1	<0.1	17000	14000	14000	12000	1500	1500	890	2900
53	23		8		**1.3**		<0.1		18000	11000	12000		830	1200	1500	
54		15		9		1		<0.1	17000			10000	1900			2200
55	15	8		13	0.83	0.8		<0.1	9400		9100	8900	2400			1500

Table 25: Aluminum, Cadmium, and Calcium Concentrations in Vegetation

Station	Aluminum				Cadmium				Calcium							
	Aspen		Forage		Aspen		Forage		Aspen				Forage			
	1992	1997	1992	1997	1992	1997	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
56	25		19		0.39		<0.1		12000		4300		1800		1500	
57	61		74		**1.3**		<0.1		7700		9000		1400		1600	
58	38	27	16	7.5	0.26	0.85	<0.1	<0.1	12000	14000	4900	9000	2100	2500	2800	1900
59	54	34	12	8	0.77	0.55	<0.1	<0.1	8200	11000	13000	15000	2100	1500	1700	2700
60	26	25	16	14	**1.6**	**1.2**	<0.1	<0.1	11000	4800	5500	4000	1500	970	1600	3200
61	16	20	7.7	12	**1.6**	**1.1**	<0.1	<0.1	10000	11000	8300	6100	2200	1400	2600	2400
62	140	11	83	360	**1.4**	0.45	<0.1	0.15	9600	10000	7300	12000	1500	2600	1600	1700
63	55	51	130	30	0.49	0.4	<0.1	<0.1	10000	7600	5500	9300	2200	1700	1100	2200
64	43	14	21	12	0.44	**1.9**	<0.1	0.15	17000	11000	6700	9700	2500	1900	1900	2900
65	150	27	68	140	0.52	0.75	<0.1	0.15	9600	11000	6100	13000	2500	1700	2400	2200
66	24		26		**1.6**		0.15		7500	10000	9000		1300	2300	2500	
67	18	22	9.7	13	0.53	**2.5**	<0.1	<0.1	7800	4200	4900	9700	2000	1300	2200	2100
68		5.5		8		1		<0.1	13000	13000		6400	4300	2200		2200
69	120	150	140	660	**1.2**	0.7	<0.1	<0.1	8700	9800	7600	9800	3300	1900	2400	4200
70	18	24	13	9	0.43	0.85	<0.1	<0.1	8100	19000	11000	11000	1900	3400	3100	1600
71	22		31		0.34		<0.1		11000	4900	13000		3300	1900	2700	
72		16	60	38		0.2	0.15	0.15	16000	17000		10000	3500	3700	2300	2700
73		16		15		**2.1**		<0.1	15000	15000		16000	2500	1400		5800
74	20	11	15	5.5	0.79	**1.8**	0.13	<0.1	13000		14000	17000	1700		3600	2600
75	13	13	9.3	5	0.7	**2.2**	<0.1	<0.1	9100		11000	13000	1500		1500	2400
76									10000	16000			2200	4000		
77	25	19	10	6	**1.7**	0.8	0.13	<0.1	14000	12000	6900	8700	3300	2600	2700	2200
78		5.5		5.5		**1.6**		<0.1	13000	8300		13000	2000	3600		2800
79									2400	6800			8000	1200		
80	29	29	21	11	0.37	0.65	<0.1	<0.1	12000	6700	3600	8100	1500	2000	1400	3600
81	25	15	11	5.5	0.69	**1.4**	<0.1	<0.1	16000	9600	6600	8600	2000	2400	3400	3100
82	24	21	20	12	**1.8**	0.75	<0.1	<0.1	13000	10000	7900	11000	3700	3800	2200	3800
83	42		28		0.57		0.11			17000	5700		1800	6200	1400	
84									14000	11000			3300	4500		
85	21		19		**2.4**		<0.1		13000	16000	10000		1900	3200	3400	
86	22		12		**1.7**		<0.1		14000	9100	11000		1900	3100	3400	
87	60	22	38	33	0.67	0.75	0.13	<0.1	21000	21000	15000	13000	3100	2300	1300	3700
88		30	68	12		**1.4**	0.12	<0.1		13000		15000	1600	2500	800	3300
89	74	13	45	12	**2**	0.6	<0.1	<0.1	13000	10000	8100	5900	930	1900	740	2600

Table 25: Aluminum, Cadmium, and Calcium Concentrations in Vegetation

Station	Aluminum				Cadmium				Calcium							
	Aspen		Forage		Aspen		Forage		Aspen				Forage			
	1992	1997	1992	1997	1992	1997	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
90	22	41	12	30	0.79	**1.6**	0.12	0.15	6100		7600	8200	2000		2100	1300
91	20	11	25	11	0.76	0.75	<0.1	0.25	11000	12000	6300	12000	830	6900	1800	1900
92	8		32		**2.2**		<0.1		13000	12000	11000		5600	5300	4200	
93	42	48	36	22	0.89	**3.8**	<0.1	<0.1	16000	8100	13000	7700	3700	2100	3000	2700
94	150	100	240	100	0.58	0.55	0.13	<0.1	16000	6000	6900	7600	2600	3200	2500	1900
95	100	25	170	17	**1.4**	0.55	0.13	<0.1	5400	9500	9200	5500	830	3300	1500	1300
96	34	12	18	17	**17**	0.9	0.17	0.15	18000	18000	18000	11000	2100	3100	2900	2700
97	36	25	69	91	0.8	0.45	<0.1	0.35	14000	10000	8800	7400	1900	4600	1200	2700
98	16	15	100	29	0.8	0.3	0.17	<0.1	10000	11000	5700	8000	3200	1500	790	1700
99	18	31	100	13	0.4	**2.2**	0.21	<0.1	19000	13000	4100	12000	2500	2200	1300	2600
100	16	15	14	19	0.72	**1.4**	0.11	<0.1	14000	8000	9600	8500	2400	3200	1300	1800
101	34	16	46	18	0.91	0.8	0.13	<0.1	17000	12000	6300	6600	3100	3300	1300	1800
102	19	12	12	8.5	**2**	0.85	<0.1	<0.1	18000	5600	7000	9800	3500	13000	1800	1700
103	16	14	9.7	6	**3.5**	0.6	<0.1	<0.1	16000	13000	10000	11000	1100	4100	1600	3100
104	26	14	17	6	0.95	0.95	<0.1	<0.1	12000	9000	6300	8400	2700	2400	1600	2100
105	27	18	20	55	0.75	**1.2**	<0.1	<0.1	14000	15000	6200	12000	2400	2600	1100	2800
106	22	9.5	15	19	0.47	0.8	0.17	<0.1	12000	11000	6000	13000	3700	2800	2000	3300
107		20		13		0.75		<0.1	12000	13000		8800	3000	2700		2100
108	19	13	35	12	0.67	**1.8**	<0.1	<0.1	9400		3600	13000	730		1700	3700
109	19	28	30	74	0.85	**1.3**	<0.1	0.15	10000		5600	12000	4200		1200	2500
110			56				0.12		9300				940		5600	
111	20	24	33	18	0.95	0.85	0.11	<0.1	13000		5800	14000	1400		1900	2500
112	22	39	18	54	0.75	**1.7**	0.13	0.25	14000		6300	9200	1700		2000	2300
113	18	58	16	89	0.7	**1.2**	0.11	<0.1	17000		7800	13000	3600		3500	4900
114	41		230		0.87		0.22		11000	13000	7700		1800	1700	3900	
ULN	500		NG		1		2		30,000				NG			

Values represent duplicate samples. Concentrations shown in bold exceed the Upper Limit of Normal Guidelines. NG = No guideline has been established.

Table 26: Lead and Magnesium Concentrations in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Lead								Magnesium							
	Aspen				Forage				Aspen				Forage			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
22	<2	1.7	0.53		<2	1.3	0.6		1900	4300	4300		1400	1900	1100	
23	<2	2	<0.5		<2	<1	<0.5		1700	1100	1600		560	940	1900	
24	<2	3	0.77		<2	1.3	0.77		2400	690	1000		200	770	720	
25	4	1.7	0.6		4	2	0.83		1500	790	1600		210	990	460	
26	3.5	3.7			3.7	<1	0.53		1300	1700			470	370	440	
27	2.3	2	<0.5	0.55	5.3	2	1.2	0.7	1400	1100	1200	1700	360	570	580	520
28	1.7		0.57		1.7		<0.5		2800		1900		920		1000	
29		3		1.7	3.3	1.7	2.7	1.8		1200		1900	740	600	790	940
30	4.3	2	1	2	2.3	1.3	3.6	0.6	1800	1100	1300	1700	1500	580	1300	1300
31	4.3			1.2	2.3		1.3	1.1	2100			880	620		700	670
32	3.7	1.3	0.57		<2	3.3	1.3		1600	670	1400		700	820	700	
33	4.7	2	1.3	0.7	3	<1	0.6	2.8	1900	1600	1700	1700	360	1400	780	770
34	2.3	3.7	<0.5	1.2	5	2.3	1	<0.5	2100	1700	1500	2500	400	910	490	1100
35	1	2	<0.5	1.2	1	1.3	0.63	0.9	2400	1500	1900	1800	540	820	890	460
36	3.7	3	1.3		2.7	3	0.67		3800	740	1500		1500	1100	760	
37	4.7		<0.5		4.7		0.6		1400		950		500		640	
38	<2		0.53		3.7		4.9		1800		2100		760		990	
39	1.3			1.1	2.7		3.7	1.4	2500			1200	350		530	420
40	1.7		0.6		5.3		1.1		1800		1900		840		560	
41	4		0.7		4		0.53		2100		2500		1400		1600	
42	4		0.57		3				1800		1600		580			
43	3	2	1.4	2	7	1.3	1.4	0.55	1600	3300	2500	3300	300	1200	1400	720
44	2.3	3		1.8	2.7	1.7	2.3	0.65	2300	2700		1400	1400	1200	860	480
45	<2	5	3.1		2.7	2	2.8		1800	1200	1600		590	950	730	
46	<2		1.4	0.85	<2		0.9	<0.5	2100		1600	1900	280		870	780
47																
48	<2	2.7	0.73	<0.5	<2	4	0.63	0.65	2700	3100	4200	4200	910	1400	1100	2700
49	<2	2	0.57	<0.5	5.7	3.3	1.1	<0.5	2400	4100	3500	4800	1000	1400	1300	2100
50	<2		<0.5	0.9	<2		2.6	0.7	2400		1800	1700	690		710	600
51	2.3				<2				1500				350			
52	<2	2.3	0.8	<0.5	<2	2.7	2.7	0.9	4700	3700	5200	2800	630	1000	750	1400
53	1.7	2.3	1.5		4	1.3	1.1		4200	2900	2100		760	1000	900	
54	2.3			<0.5	3.3			0.8	4200			2300	1400			860
55	<2		0.83	0.6	1.3			0.85	3100		1900	2500	1400			540

Table 26: Lead and Magnesium Concentrations in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Lead								Magnesium							
	Aspen				Forage				Aspen				Forage			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
56	<2		0.93		<2		1.4		2200		1900		430		740	
57	<2		0.67		<2		0.8		1400		3400		610		890	
58	4.7	4.7	<0.5	0.8	3.3	<1	<0.5	0.8	2000	3000	2300	2600	470	1200	1200	800
59	<2	2.3	<0.5	0.85	<2	1.7	0.6	<0.5	1400	2000	2400	4600	1200	830	640	930
60	2.7	2.3	<0.5	1.9	<2	2	1.3	0.7	1800	1800	1600	2000	610	540	540	520
61	6.3	2	<0.5	0.95	6.3	<1	0.77	0.65	2000	3000	1400	1700	410	530	560	580
62	2.7	2.3	0.7	0.6	<2	1.3	1.2	1.2	2000	2700	3600	3400	440	1300	1300	900
63	<2	2.3	0.7	0.6	<2	4	0.9	0.7	4100	3300	2300	2600	1000	1200	750	1400
64	<2	1.7	1.1	<0.5	<2	<1	<0.5	<0.5	4400	3000	3100	2900	800	850	720	1300
65	<2	<1	0.83	0.55	<2	<1	1.1	0.8	2900	2400	2100	3000	500	680	680	1100
66	<2	<1	0.77		<2	<1	<0.5		3000	2100	2900		470	1400	1400	
67	<2	<1	0.57	0.8	<2	<1	0.57	0.7	2900	1500	1800	2400	1100	730	960	800
68	<2	<1		<0.5	<2	<1		0.6	1200	2100		2200	940	860		730
69	<2	<1	<0.5	<0.5	<2	<1	<0.5	0.75	2000	2100	1700	3200	1500	870	700	2200
70	<2	1.7	0.57	0.6	<2	<1	<0.5	<0.5	2300	2700	1800	2800	590	1100	1000	690
71	<2	<1	<0.5		<2	<1	0.67		2100	1400	3000		1700	670	1100	
72	4.7	3		1.2	9.7	2	5.9	1.8	3900	4100		4400	1000	1600	1000	890
73	<2	<1		0.9	<2	2.7		0.85	1200	2100		3200	710	780		2600
74	5		<0.5	0.95	<2		0.8	0.6	1300		2300	2400	560		1600	910
75	<2		<0.5	0.85	<2		<0.5	0.55	1600		3100	1300	730		570	790
76	6	7.3			3.3	1.3			1300	2400			850	1200		
77	6	4.3	<0.5	0.7	<2	2	0.73	<0.5	1200	1400	1000	1600	670	670	1300	850
78	<2	7.3		<0.5	<2	1.7		<0.5	3000	1300		2800	730	1100		1200
79	<2	1.7			<2	1.7			430	2200			2900	1100		
80	<2	7	<0.5	<0.5	1.7	<1	0.63	0.6	3300	2600	1800	1900	690	400	880	1100
81	3.7	2	0.53	0.65	3.7	<1	<0.5	<0.5	4700	3900	2400	3800	1200	1300	770	1000
82	4	2.7	<0.5	0.65	<2	<1	<0.5	0.7	2800	3500	3100	3100	1100	1800	1300	2400
83		4.7	0.53		<2	2.7	3.4			870	3000		790	1600	1100	
84	5.3	2			6.7	2.3			1300	1300			1000	1000		
85	3.3	2.3	<0.5		<2	<1	0.63		2300	2200	2200		790	1200	1200	
86	<2	1.7	<0.5		5	<1	<0.5		1800	1800	2100		880	1000	1600	
87	5	11	1.1	1	15	7.7	5	1.1	1700	1500	1900	2400	1200	720	750	930
88		6		0.8	3.7	4.3	3.2	0.55		3100		4900	1800	1300	690	1500
89	3.3	4	1	<0.5	3.3	2	1.6	0.65	4500	3600	1200	1300	850	980	690	1100

Table 26: Lead and Magnesium Concentrations in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey.

Station	Lead								Magnesium							
	Aspen				Forage				Aspen				Forage			
	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997	1981	1986	1992	1997
90	3		0.63	<0.5	2.3		1.1	0.55	2200		1300	2700	1900		560	780
91	3	2	1.2	0.6	2.3	4.7	1.5	<0.5	4200	1600	2000	2200	460	1800	510	640
92	2.7	1.3	<0.5		1	1.7	<0.5		4000	2300	2500		2000	1400	1500	
93	1.3	1.7	<0.5	<0.5	1	<1	<0.5	<0.5	4200	1400	2700	2900	1200	860	950	1000
94	<2	2.3	0.6	<0.5	3.3	15	0.7	<0.5	3300	1600	2000	2100	1100	1200	1000	1200
95	1.7	1.3	1	0.6	2.3	3	1.9	0.55	2700	910	1600	1200	630	650	460	470
96	9	4.3	2.4	0.75	<2	1.3	3	2	2900	3600	5600	2600	1000	1600	1200	1500
97	5.3	9.3	2.7	0.8	<2	2.5	1.8	14	1500	1500	1300	1600	1100	1900	870	1200
98	3	3.3	1.6	0.55	4	<1	8.7	1.5	1600	2600	2300	2600	920	920	400	1600
99	4.3	3.3	1.3	0.55	10	<1	4	0.6	2600	1800	1400	2200	1200	880	640	1100
100	3	4.7	1.1	<0.5	1	2.7	0.9	<0.5	4200	1900	2500	1500	1500	1100	530	1200
101	3	5	0.63	0.75	<2	4.3	2.4	1.4	1800	2600	2000	1500	930	1300	580	590
102	3	3.7	<0.5	<0.5	5	4	<0.5	0.55	6000	1700	2100	2700	1700	3400	720	910
103	1	4.7	<0.5	<0.5	1	5.7	<0.5	<0.5	4500	3100	2500	3400	890	1600	950	1100
104	4.3	3	<0.5	<0.5	1	2.7	0.57	0.6	4700	3300	2500	2900	5700	790	630	690
105	3.3	<1	<0.5	0.55	<2	<1	0.63	1.1	3000	2700	2100	3000	780	800	610	1700
106	8.3	4.3	0.53	0.8	2.3	7	0.7	1.6	3400	3400	2800	4900	1600	1100	880	1500
107	3	3		1.5	3.7	<1		0.75	4400	3200		1400	1400	1900		600
108	1.3		0.67	0.65	1		1.7	1.4	6600		1700	3200	650		1100	2000
109	<2		<0.5	1.9	1		1.1	0.85	5800		3100	2600	2400		880	750
110	<2				<2		0.67		2700				330		340	
111	1		1.1	0.6	2.3		2.4	<0.5	6300		2000	3100	540		900	1000
112	1.3		0.7	1.5	1		<0.5	<0.5	3000		1700	2200	890		720	880
113	1		<0.5	0.95	1.3		0.9	<0.5	3900		2000	1700	1400		1100	1200
114	6.3	1.3	<0.5		4.7	<1	<0.5		1800	2100	1200		1400	500	1700	
ULN	30				20				7000				NG			

Values represent duplicate samples. Concentrations shown in bold exceed the Upper Limit of Normal Guidelines. NG = No guideline has been established.

Table 27: Additional Elements Analyzed for in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey in 1997.

Station	Aspen										Forage									
	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V
22																				
23																				
24																				
25																				
26																				
27	22	25	<0.2	**0.18**	<0.5	1.3	590	0.2	32	0.5	21	7	<0.2	0.44	<0.5	1.7	740	0.25	6	0.5
28																				
29	30	10	<0.2	**0.65**	<0.5	0.97	95	0.7	25	0.5	39	1.5	<0.2	0.42	<0.5	0.98	36	4.9	5.8	0.5
30	18	13	<0.2	**0.41**	0.95	1.3	81	0.65	11	0.5	33	3.5	<0.2	1	1.2	2.5	45	3.3	13	0.5
31	8.8	31	<0.2	**0.26**	<0.5	1.1	180	0.2	15	0.5	19	2	<0.2	0.1	0.7	1.9	680	1.4	4.6	0.55
32																				
33	47	32	<0.2	**0.44**	1	1.6	320	0.2	55	0.5	18	6.5	<0.2	0.59	1	1.8	1100	0.6	6.7	0.6
34	51	24	<0.2	**0.24**	<0.5	1.2	210	0.2	69	0.5	31	2	<0.2	0.62	<0.5	1.9	96	0.8	13	0.5
35	90	35	<0.2	**0.28**	<0.5	1.7	250	0.2	69	0.5	25	3	<0.2	0.44	<0.5	1.7	270	0.4	8.7	0.5
36																				
37																				
38																				
39	8.6	15	<0.2	0.09	<0.5	0.85	200	0.2	55	0.5	17	4	<0.2	0.2	<0.5	0.77	240	0.35	4.7	0.5
40																				
41																				
42																				
43	20	29	<0.2	**0.17**	<0.5	0.66	69	0.2	38	0.5	18	3.5	<0.2	0.38	<0.5	1.2	250	0.2	9.4	0.5
44	22	26	<0.2	**0.32**	<0.5	1	30	0.4	25	0.5	18	2.5	<0.2	0.38	<0.5	1.3	7.4	2.1	5.5	0.5
45																				
46	10	31	<0.2	**0.21**	<0.5	1.2	200	0.2	17	0.5	17	2	<0.2	0.47	<0.5	1.8	300	0.8	3.8	0.5
47																				
48	14	19	<0.2	**0.67**	<0.5	1.2	74	0.2	22	0.5	4.7	3.5	<0.2	0.47	<0.5	1.8	19	1	4	0.5
49	20	12	<0.2	**0.22**	<0.5	0.59	38	0.2	18	0.5	15	3	<0.2	0.5	<0.5	1.6	14	0.75	5.6	0.5
50	39	26	<0.2	**0.35**	<0.5	0.91	80	0.2	34	0.5	28	2.5	<0.2	0.64	0.55	2	50	0.2	12	0.5
51																				
52	21	24	<0.2	**0.31**	<0.5	1.2	260	0.2	66	0.5	25	2	<0.2	0.45	<0.5	2.3	320	0.3	18	0.5
53																				
54	23	33	<0.2	0.13	0.55	0.93	110	0.2	40	0.5	39	4.5	<0.2	0.31	<0.5	1.4	270	0.55	12	0.5
55	9.5	19	<0.2	0.06	<0.5	0.75	77	0.2	20	0.5	16	2	<0.2	0.16	<0.5	1.2	340	0.2	6.7	0.5

Table 27: Additional Elements Analyzed for In Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey in 1997.

Station	Aspen										Forage									
	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V
56																				
57																				
58	53	19	<0.2	0.14	0.55	1.1	98	0.2	55	0.5	19	3.5	<0.2	0.45	<0.5	1.4	150	0.2	5.8	0.5
59	37	33	<0.2	**0.28**	<0.5	0.93	370	0.2	82	0.5	42	3.5	<0.2	0.91	<0.5	2	580	0.2	13	0.5
60	27	20	<0.2	0.11	0.55	1.4	220	0.2	15	0.5	62	4	<0.2	0.46	<0.5	1.5	290	0.25	19	0.5
61	51	15	<0.2	**0.39**	<0.5	1.4	110	0.2	41	0.5	38	4.5	<0.2	0.43	<0.5	1.7	180	0.5	14	0.5
62	12	25	<0.2	**0.21**	<0.5	0.82	88	0.2	35	0.5	18	3	<0.2	0.26	1.4	1.3	50	0.3	6.1	1.2
63	12	19	<0.2	**0.26**	<0.5	0.97	94	0.2	25	0.5	24	3.5	<0.2	0.75	<0.5	1.9	230	0.3	9.6	0.5
64	24	23	<0.2	0.09	<0.5	0.8	83	0.2	31	0.5	20	3.5	<0.2	0.25	<0.5	1.8	310	0.2	12	0.5
65	62	17	<0.2	**0.48**	<0.5	0.95	160	0.2	49	0.5	20	7.5	<0.2	0.51	1	2.1	380	0.25	7.8	0.6
66																				
67	82	26	<0.2	0.07	<0.5	0.9	170	0.2	54	0.5	16	2.5	<0.2	0.29	<0.5	1.5	180	1.2	7.8	0.5
68	6.9	24	<0.2	0.08	<0.5	1.2	52	0.2	18	0.5	18	3	<0.2	0.39	<0.5	2	240	1.4	8.1	0.5
69	44	12	<0.2	0.13	0.55	0.7	77	0.2	46	0.5	38	4.5	<0.2	0.79	2.5	2	49	0.2	17	1.6
70	40	16	<0.2	0.11	<0.5	0.9	100	0.2	61	0.5	8.7	1.5	<0.2	0.37	<0.5	1.5	310	0.2	6.3	0.5
71																				
72	22	20	<0.2	**0.33**	<0.5	0.76	22	0.25	8.8	0.5	21	2	<0.2	0.66	<0.5	1.7	14	1.4	7	0.5
73	16	21	<0.2	**0.25**	<0.5	0.87	41	0.2	28	0.5	14	3	<0.2	0.99	<0.5	1.8	77	0.8	11	0.5
74	44	42	<0.2	**0.23**	<0.5	1.4	76	0.2	50	0.5	20	3	<0.2	0.92	<0.5	2.4	66	0.3	6	0.5
75	12	19	<0.2	0.12	<0.5	0.95	62	0.2	19	0.5	11	3.5	<0.2	0.46	<0.5	1.7	36	1.8	6.9	0.5
76																				
77	34	34	<0.2	0.15	<0.5	1.3	60	0.2	47	0.5	37	4	<0.2	0.34	<0.5	2	22	0.55	8.3	0.5
78	16	30	<0.2	**0.17**	<0.5	1	50	0.2	23	0.5	21	3	<0.2	0.68	<0.5	1.7	47	0.65	7.5	0.5
79																				
80	25	21	<0.2	**0.34**	<0.5	1	110	0.2	31	0.5	8.9	5.5	<0.2	0.63	<0.5	2.2	110	1.4	3.4	0.5
81	14	25	<0.2	0.1	<0.5	0.87	92	0.2	28	0.5	27	3	<0.2	0.18	<0.5	1.8	19	0.45	9.6	0.5
82	8.3	21	<0.2	0.11	<0.5	0.8	44	0.2	11	0.5	17	3	<0.2	0.34	<0.5	2.1	40	0.35	5.5	0.5
83																				
84																				
85																				
86																				
87	14	29	<0.2	**0.3**	<0.5	1	36	0.2	21	0.5	19	3	<0.2	0.75	<0.5	2.1	11	0.45	9.6	0.5
88	10	11	<0.2	**0.26**	<0.5	0.95	37	0.2	18	0.5	9.1	5.5	<0.2	0.44	<0.5	1.9	15	0.35	6.7	0.5
89	10	36	<0.2	**0.16**	<0.5	0.69	72	0.2	27	0.5	27	3.5	<0.2	0.55	<0.5	1.7	170	0.45	14	0.5

Table 27: Additional Elements Analyzed for in Vegetation at 92 Stations in the Sudbury Area as part of the Special Survey in 1997.

Station	Aspen										Forage									
	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V	Ba	B	Be	Cl%	Cr	K	Mn	Mo	Sr	V
90	23	25	<0.2	**0.16**	<0.5	0.99	100	0.2	35	0.5	8.9	3.5	<0.2	0.76	<0.5	1.8	98	0.4	5.5	0.5
91	16	28	<0.2	**0.19**	<0.5	1	76	0.25	28	0.5	18	2	<0.2	0.6	1.1	1.8	570	0.55	5.7	0.5
92																				
93	29	18	<0.2	**0.28**	<0.5	1	150	0.2	59	0.5	14	2.5	<0.2	0.76	<0.5	1.9	100	0.35	53	0.5
94	59	19	<0.2	**0.16**	0.6	1.2	270	0.2	54	0.5	39	3.5	<0.2	0.6	1	2	120	0.25	9.7	0.5
95	53	31	<0.2	**0.21**	<0.5	1.4	180	0.2	33	0.5	23	2	<0.2	0.46	<0.5	1.7	310	0.2	5.6	0.5
96	12	35	<0.2	**0.62**	<0.5	1.3	22	0.25	20	0.5	11	4	<0.2	0.81	<0.5	1.8	220	0.7	6.4	0.5
97	13	23	<0.2	**0.28**	<0.5	1.1	46	0.2	19	0.5	27	3	<0.2	0.47	0.75	1.5	160	1.1	8.1	0.5
98	9.8	20	<0.2	**0.16**	<0.5	0.81	140	0.2	63	0.5	16	2	<0.2	0.43	<0.5	2	94	0.25	15	0.5
99	22	27	<0.2	**0.33**	<0.5	1.2	75	0.2	31	0.5	13	4.5	<0.2	0.73	<0.5	1.6	300	0.85	5.3	0.5
100	23	26	<0.2	**0.5**	<0.5	1.2	63	0.2	21	0.5	16	3	<0.2	0.87	<0.5	1.6	200	0.45	9.1	0.5
101	23	18	<0.2	0.1	<0.5	1.1	240	0.2	21	0.5	12	7	<0.2	0.54	<0.5	1.7	350	0.55	5.3	0.5
102	23	9	<0.2	**0.18**	<0.5	0.87	69	0.2	47	0.5	17	3.5	<0.2	0.55	<0.5	1.8	320	0.2	8.1	0.5
103	40	21	<0.2	0.15	<0.5	1.1	100	0.2	67	0.5	9.3	5	<0.2	0.43	<0.5	1.8	57	0.25	15	0.5
104	24	21	<0.2	0.15	<0.5	1.1	110	0.2	48	0.5	32	2	<0.2	0.72	<0.5	1.7	540	0.4	10	0.5
105	20	20	<0.2	0.09	<0.5	0.97	90	0.2	57	0.5	11	3	<0.2	0.39	0.65	2	100	0.35	11	0.5
106	15	28	<0.2	**0.28**	<0.5	0.84	23	0.3	30	0.5	8.9	5.5	<0.2	0.68	<0.5	2	110	0.7	13	0.5
107	5.9	16	<0.2	**0.18**	<0.5	1.1	17	0.35	11	0.5	5.2	2.5	<0.2	0.25	<0.5	1.1	13	1.4	3.6	0.5
108	11	50	<0.2	**0.39**	<0.5	0.66	130	0.2	37	0.5	33	3.5	<0.2	0.85	<0.5	1.8	210	0.25	9.3	0.5
109	45	33	<0.2	**0.36**	<0.5	1.1	74	0.2	40	0.5	23	3.5	<0.2	0.73	0.6	1.7	220	0.35	9.8	0.5
110																				
111	37	28	<0.2	**0.43**	<0.5	1.1	120	0.2	64	0.5	24	2	<0.2	0.64	<0.5	1.8	110	0.25	9.1	0.5
112	55	19	<0.2	0.12	<0.5	1	290	0.2	55	0.5	30	3	<0.2	0.24	<0.5	1.8	530	0.3	12	0.5
113	91	29	<0.2	0.09	<0.5	0.99	67	0.25	62	0.5	59	5	<0.2	0.08	<0.5	2.3	61	0.65	24	0.5
114																				
ULN	NG	75	NG	0.15	8	NG	NG	1.5	NG	5	NG	20	NG	1.0	5	NG	NG	6	NG	6

Values represent duplicate samples. Concentrations shown in bold exceed the Upper Limit of Normal Guidelines. NG = No guideline has been established.

Table 28: Metals Concentration in Surface Soil Collected in 2000.

Station	Al	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	Sr	V	Zn
337	12000	17	73	<0.5	**1.6**	5300	47	**26**	**440**	23000	91	4900	320	0.55	**530**	**2.9**	39	37	74
338	14000	13	55	<0.5	0.9	4700	33	14	**290**	20000	52	4200	200	<0.5	**260**	1.8	21	39	50
339	12000	**19**	58	<0.5	0.95	2100	35	17	**360**	24000	54	2800	170	0.55	**330**	**2.5**	21	39	45
340	13000	8.5	36	<0.5	0.75	2000	29	8.9	**130**	17000	30	2500	250	<0.5	**140**	1.3	18	37	40
341	5500	11	100	<0.5	**1.3**	2500	16	11	**180**	10000	41	1900	570	<0.5	**210**	1.5	21	22	48
342	8600	9.2	31	<0.5	0.55	3000	25	7	80	11000	26	2600	140	<0.5	**91**	0.6	22	28	37
343	6900	2.8	31	<0.5	0.5	6500	28	6.1	25	10000	9	3700	250	<0.5	36	0.3	24	25	54
344	9900	6.4	35	<0.5	0.6	3800	28	6.4	57	11000	17	2700	180	<0.5	**66**	0.65	22	27	28
345	7000	3.9	27	<0.5	0.4	2500	26	4.8	37	9600	15	2000	160	<0.5	**47**	0.45	18	24	20
346	9000	5.7	28	<0.5	0.45	1300	20	4.8	35	10000	14	1500	190	<0.5	43	0.45	11	27	28
347	5500	7.9	74	<0.5	0.9	1800	14	7.4	**110**	9100	27	940	770	<0.5	**150**	1	17	21	46
348	12000	7.8	41	<0.5	0.7	2100	29	7.3	**92**	16000	21	2700	300	0.8	**96**	0.95	18	34	48
349	5400	16	16	<0.5	0.35	1300	21	6.1	**100**	11000	24	1600	130	<0.5	**100**	1.4	11	31	19
350	8500	7.1	33	<0.5	0.5	2700	21	5.7	56	11000	26	1700	160	<0.5	**78**	0.55	18	25	36
351	5900	**19**	62	<0.5	**1.6**	4300	23	13	**300**	18000	84	1400	120	1.4	**330**	**3.2**	22	28	61
352	12000	9.4	87	<0.5	0.9	2900	35	8.8	**110**	21000	40	2900	430	0.7	**130**	1.5	25	48	95
353	8800	8.7	89	<0.5	**1.5**	2900	34	8.3	**110**	18000	82	2500	220	0.75	**130**	1.5	24	50	86
354	7200	**19**	45	<0.5	0.55	2200	19	7.9	**200**	9400	47	1200	71	<0.5	**210**	**2.5**	20	18	22
355	8700	4.4	23	<0.5	0.25	2000	25	5.6	52	12000	16	2800	140	<0.5	40	0.45	15	30	20
356	4800	9.6	50	<0.5	0.5	1900	19	6	**130**	9400	35	1600	79	0.6	**120**	0.95	15	24	25
357	4300	7.5	30	<0.5	0.35	1500	13	4.1	60	7400	35	750	89	<0.5	**86**	1.1	17	26	21
358	5300	**130**	110	<0.5	1	5000	21	**26**	**740**	20000	**140**	3100	79	1	**520**	**3.4**	13	29	34
359	7600	**70**	40	<0.5	0.45	1800	23	16	**260**	16000	61	2100	91	0.9	**250**	**2.1**	16	32	26
360	8800	**25**	46	<0.5	0.5	1700	21	12	**330**	16000	34	1700	110	<0.5	**260**	2	17	30	42
361	8900	1.6	55	<0.5	0.3	3000	33	9.3	52	13000	14	4100	210	<0.5	**66**	0.45	24	30	25
362	16000	**22**	39	0.65	0.5	4200	25	17	**450**	21000	53	3300	130	1	**420**	**3.7**	15	35	46
363	18000	12	57	<0.5	0.65	2700	39	21	**390**	18000	30	3600	120	0.55	**470**	**2.2**	20	37	49
364	9800	14	34	<0.5	0.4	1300	23	10	**280**	17000	22	1700	100	<0.5	**210**	1.6	14	34	36
365	9600	9.1	52	<0.5	0.4	1900	25	12	**190**	15000	21	2400	230	<0.5	**190**	1.4	16	30	49
366	21000	9.9	32	<0.5	0.4	3800	34	8.1	**190**	24000	29	1900	92	0.7	**170**	1.9	16	41	59
367	8200	11	37	<0.5	<0.2	1700	23	11	**210**	15000	29	2300	91	0.65	**210**	1.8	15	24	23
368	16000	14	91	<0.5	0.35	2800	47	**23**	**400**	25000	30	5400	410	<0.5	**490**		31	41	51
369	18000	10	56	<0.5	0.4	1800	35	11	**270**	20000	22	3200	150	<0.5	**210**		20	36	59

Table 28: Metals Concentration in Surface Soil Collected in 2000.

Station	Al	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	Sr	V	Zn
370	12000	**73**	78	<0.5	0.65	2200	36	**28**	**640**	**36000**	48	3400	300	0.6	**690**		16	59	69
371	10000	**21**	44	<0.5	0.65	1400	29	18	**340**	19000	34	2200	260	0.55	**370**		12	29	49
372	8700	10	36	<0.5	0.45	2700	28	11	**150**	13000	20	3200	290	<0.5	**170**		19	25	38
373	13000	8.8	53	<0.5	0.45	1700	32	12	84	18000	19	3300	340	0.55	**110**		15	30	64
374	16000	16	78	<0.5	0.8	2000	37	13	**160**	18000	26	3300	410	<0.5	**190**		15	32	160
375	17000	11	90	<0.5	0.6	3400	58	17	**180**	25000	30	7100	440	<0.5	**230**		32	45	75
376	13000	**37**	72	<0.5	0.75	2400	27	18	**350**	25000	46	3000	670	<0.5	**310**		13	48	71
377	11000	17	78	<0.5	0.5	2800	28	11	**180**	21000	29	3700	230	0.65	**180**		21	44	32
378	8100	5.1	34	<0.5	0.35	2800	23	13	**180**	12000	16	2500	140	<0.5	**250**		16	24	32
379	26000	9	160	0.65	1	3800	61	**31**	**140**	27000	26	6800	1100	<0.5	**190**		29	52	87
380	18000	8.5	85	<0.5	0.4	4600	45	**29**	**110**	33000	16	7200	860	0.75	**120**		22	70	51
381	12000	6.4	63	<0.5	0.25	2800	25	7.2	35	19000	11	4300	260	0.6	40		20	42	30
382	13000	**19**	88	<0.5	**1.1**	4000	30	21	**220**	33000	40	4400	370	<0.5	**250**		28	67	81
383	10000	**18**	92	<0.5	1	1900	21	10	**230**	17000	44	1600	290	0.65	**220**		18	33	50
384	21000	15	87	<0.5	0.7	2800	58	17	**130**	**47000**	32	13000	1500	1.5	**170**		12	83	120
385	9200	6.1	46	<0.5	<0.2	2700	25	5.9	49	11000	17	2200	340	<0.5	**65**		21	26	35
386	16000	5.8	54	<0.5	0.5	4300	43	11	66	19000	34	5000	230	<0.5	**83**		32	40	47
387	14000	4.7	110	<0.5	0.6	3400	35	7.9	37	17000	21	3200	530	<0.5	**55**		29	36	83
388	8600	3.3	30	<0.5	0.25	3200	29	7.9	56	15000	21	4100	170	<0.5	**80**		19	35	39
389	11000	5.3	130	<0.5	0.3	2700	26	7	69	16000	**160**	2200	320	0.6	**83**		22	37	79
390	12000	3.6	70	<0.5	<0.2	2300	29	7.4	33	16000	30	3300	340	<0.5	39		18	41	42
391	8000	2	42	<0.5	0.3	5100	24	5.5	14	10000	12	2600	460	<0.5	25		21	25	35
392	12000	3.3	87	<0.5	0.7	10000	37	7.2	40	14000	22	3800	450	<0.5	**64**		47	32	110
393	18000	**28**	73	<0.5	0.5	4500	55	**26**	**130**	**45000**	49	6500	1200	3.6	**110**		33	55	130
394	5600	2	16	<0.5	<0.2	2500	23	5.9	25	9800	11	2900	210	<0.5	31		15	23	27
395	10000	7.3	87	<0.5	0.55	3000	30	8.8	**87**	13000	32	2900	600	0.6	**100**		27	31	58
396	19000	4.5	59	<0.5	0.45	2400	37	12	76	23000	22	5000	370	0.6	**79**		19	49	67
397	15000	16	77	<0.5	0.45	3600	29	16	81	22000	31	5400	490	<0.5	**65**		16	48	150
398	14000	3	70	<0.5	0.4	2800	39	11	28	19000	15	5200	290	<0.5	41		28	41	47
399	14000	4.7	90	<0.5	0.45	4200	45	13	64	19000	24	5500	660	<0.5	**79**		38	41	89
400	19000	4.2	95	0.55	0.45	6000	70	17	46	28000	21	9400	590	0.7	**58**		43	61	90
401	8600	13	47	<0.5	0.4	1800	21	7.5	**160**	16000	48	1800	150	0.9	**140**		15	32	48
402	18000	4	100	<0.5	0.65	3800	45	11	41	19000	25	5100	740	0.7	**62**		38	46	80
403	13000	16	46	<0.5	0.7	1600	27	9.7	**250**	19000	49	1600	100	0.75	**230**		13	35	48
404	14000	6.4	36	<0.5	0.5	1300	33	11	**110**	18000	20	3100	100	<0.5	**120**		13	33	56
405	11000	**33**	77	<0.5	0.8	950	26	19	**600**	21000	68	1900	140	0.55	**470**		12	30	63

Table 28: Metals Concentration in Surface Soil Collected in 2000.

Station	Al	As	Ba	Be	Cd	Ca	Cr	Co	Cu	Fe	Pb	Mg	Mn	Mo	Ni	Se	Sr	V	Zn
406	15000	4.6	60	<0.5	0.25	2300	40	11	57	16000	10	4200	220	<0.5	**58**		20	34	31
407	15000	12	34	<0.5	<0.2	1700	52	9.2	**86**	16000	13	3400	140	<0.5	**63**		15	35	28
408	9500	14	71	<0.5	<0.2	1600	25	11	**220**	14000	23	2300	120	<0.5	**190**		18	28	34
409	8800	**23**	40	<0.5	0.25	1000	21	11	**230**	16000	23	1400	73	<0.5	**210**		12	28	32
410	11000	**26**	47	<0.5	0.4	700	29	13	**330**	19000	45	1700	110	0.8	**270**		8	29	34
411	12000	**77**	44	<0.5	0.7	1400	37	**36**	**690**	26000	80	1700	120	0.8	**980**		12	33	56
412	5800	16	24	<0.5	<0.2	1400	20	7.3	**130**	10000	21	2100	75	<0.5	**140**		11	21	17
413	3800	**25**	30	<0.5	0.25	450	9.5	4.7	**190**	8400	25	490	39	<0.5	**100**		5.5	19	9.5
414	4800	**37**	81	<0.5	0.6	950	18	15	**530**	15000	64	1100	59	0.55	**360**		10	25	21
415	6900	5.5	27	<0.5	<0.2	2400	20	5.6	84	8900	8.5	2200	110	<0.5	**79**		20	22	13
416	15000	8.1	53	<0.5	0.5	2500	38	9.7	**120**	18000	22	3700	220	<0.5	**120**		25	36	54
417	14000	9.2	67	<0.5	0.3	2600	36	15	**180**	19000	17	3700	220	<0.5	**200**		31	37	34
418	17000	9.9	96	<0.5	0.3	2800	51	13	**130**	22000	20	6000	230	<0.5	**120**		32	43	38
419	10000	10	45	<0.5	0.3	1900	31	11	**110**	17000	21	3600	260	<0.5	**100**		16	32	36
420	10000	4.8	51	<0.5	0.45	2700	29	8.5	38	14000	15	3700	360	<0.5	**49**		28	29	35
421	11000	14	51	<0.5	0.8	1800	32	8.1	**180**	18000	43	2600	140	<0.5	**130**		17	39	68
422	4200	14	94	<0.5	0.65	1500	12	6.3	**150**	7700	44	720	140	0.65	**180**		14	20	30
423	9100	4.2	21	<0.5	0.25	2600	31	8.1	41	15000	11	4300	190	<0.5	**45**		18	32	26
424	11000	15	110	<0.5	0.7	2700	32	14	**220**	18000	51	3000	230	0.6	**240**		20	33	41
425	14000	15	71	<0.5	0.45	2900	44	16	**200**	20000	39	5000	260	0.6	**230**		24	37	46
426	16000	5	94	<0.5	0.35	3200	52	13	59	21000	22	6800	450	<0.5	**88**		32	41	65
427	9800	10	62	<0.5	0.55	3000	32	19	**280**	16000	23	3700	170	<0.5	**320**		21	30	46
428	20000	7	27	<0.5	0.4	1300	44	6.7	68	20000	19	2100	110	1.1	41		11	41	39
429	7200	**20**	61	<0.5	0.7	1600	22	17	**440**	16000	48	1700	87	0.7	**480**		17	26	40
430	10000	6.2	54	<0.5	0.55	2700	33	12	**110**	15000	30	4200	340	<0.5	**150**		23	29	51
431	10000	8.8	54	<0.5	0.45	1400	25	9.2	**93**	15000	24	2400	270	0.8	**110**		13	30	51
432	6100	**29**	52	<0.5	0.35	1100	22	19	**410**	16000	42	1700	150	0.9	**430**		9	26	52
433	12000	15	70	<0.5	0.3	3300	42	19	**190**	21000	61	4400	260	0.75	**250**		24	37	50
434	9200	**32**	39	<0.5	0.25	1300	24	16	**360**	21000	67	1800	110	1.1	**380**		9.5	33	46
435	10000	9.1	85	<0.5	0.3	3400	33	9.8	**120**	16000	34	3900	220	0.65	**140**		30	33	33
436	9000	11	53	<0.5	0.45	2900	15	8.8	**140**	17000	35	3300	140	<0.5	**130**		8.5	56	27
437	8500	12	65	<0.5	0.45	1700	18	8	**200**	12000	40	1400	130	<0.5	**160**		15	26	39
438	6200	9.4	46	<0.5	<0.2	2500	9	8.9	**100**	17000	27	2800	160	<0.5	**73**		6.5	70	27
439	6900	5.2	78	<0.5	0.45	2300	25	6.7	57	13000	23	2600	310	<0.5	**75**		19	31	43
Table F	30000*	17	210	1.2	1.0	55000*	71	21	85	35000*	120	20000*	2200*	2.5	43	1.9	64*	91	160
Table A	NG	20	750	1.2	12	NG	750	40	225	NG	200	NG	NG	40	150	10	NG	200	600

Blank cells - no data available.

Concentrations shown in bold exceed the Table F or OTR_{98} Background Guidelines Values shown in bold and underlined exceed the Table A Soil Clean up Guidelines.

NG = no Soil Clean-up Guidelines have been established.

* OTR_{98} substituted where Table F Guidelines do not exist.

Table 29: Sampling Station Coordinates (Latitude & Longitude and UTM)

MOE Station No.	Map Station No.	Longitude	Latitude	Zone	Easting	Northing
5030001	1 Blind River	-82.975398	46.255776	17	347748	5124363
5030002	2 Burwash	-80.797196	46.291231	17	515621	5126426
5030003	3 Callum	-80.650139	46.523403	17	526834	5152263
5030004	4 Chiniguchi	-80.651862	46.970382	17	526482	5201932
5030005	5 Fairbanks	-81.440226	46.468265	17	466201	5146171
5030006	6 Garson	-80.945004	46.53791	17	504217	5153817
5030007	7 Grassey Lake	-80.297183	46.82117	17	553610	5185532
5030008	8 Killarney	-81.403911	46.0137	17	468732	5095649
5030009	9 Kukagami Lake	-80.567965	46.719795	17	533017	5174117
5030010	10 Mattawa	-78.826508	46.386157	17	667122	5139249
5030011	11 Milnet	-80.960904	46.825274	17	502982	5185749
5030012	12 Morgan	-81.237662	46.629129	17	481807	5163979
5030013	13 Nairn	-81.674687	46.304711	17	448045	5128125
5030014	14 Lake Penage	-81.344743	46.274322	17	473438	5124585
5030015	15 Rayside	-81.028445	46.615828	17	497822	5162474
5030016	16 St. Charles	-80.405207	46.361881	17	545755	5134428
5030017	17 Skead	-80.766571	46.656478	17	517860	5167017
5030018	18 Sturgeon Falls	-79.99502	46.393697	17	577264	5138282
5030019	19 Ramsey Lake	-80.956801	46.463218	17	503317	5145517
5030020	20 Temagani	-79.99116	46.952725	17	576765	5200405
5030021	21 Tilton Lake	-81.071954	46.353335	17	494464	5133309
5030022	22	-80.810748	46.581234	17	514500	5158647
5030023	23	-80.814434	46.58367	17	514217	5158917
5030024	24	-80.816977	46.603473	17	514017	5161117
5030025	25	-80.826066	46.619686	17	513317	5162917
5030026	26	-80.829956	46.628691	17	513017	5163917
5030027	27	-80.796404	46.640525	17	515582	5165238
5030028	28	-80.845403	46.708807	17	511817	5172817
5030029	29	-80.802236	46.589013	17	515150	5159513
5030030	30	-80.798737	46.592643	17	515417	5159917
5030031	31	-80.783434	46.603459	17	516586	5161122

Table 29: Sampling Station Coordinates (Latitude & Longitude and UTM)

MOE Station No.	Map Station No.	Longitude	Latitude	Zone	Easting	Northing
5030032	32	-80.777729	46.622302	17	517017	5163217
5030033	33	-80.766508	46.631702	17	517873	5164264
5030034	34	-80.764139	46.647779	17	518049	5166051
5030035	35	-80.74379	46.681402	17	519594	5169792
5030036	36	-80.814477	46.57486	17	514216	5157938
5030037	37	-80.821004	46.570181	17	513717	5157417
5030038	38	-80.84842	46.565721	17	511617	5156917
5030039	39	-80.858937	46.555736	17	510813	5155806
5030040	40	-80.873245	46.551352	17	509717	5155317
5030041	41	-80.899352	46.541479	17	507717	5154217
5030042	42	-80.913713	46.532491	17	506617	5153217
5030043	43	-80.935889	46.526206	17	504917	5152517
5030044	44	-80.810559	46.571964	17	514517	5157617
5030045	45	-80.807977	46.563861	17	514717	5156717
5030046	46	-80.814569	46.544072	17	514217	5154517
5030047	47	-80.818535	46.52788	17	513917	5152717
5030048	48	-80.840823	46.486515	17	512217	5148117
5030049	49	-80.836871	46.500908	17	512517	5149717
5030050	50	-80.838129	46.51621	17	512417	5151417
5030051	51	-80.93475	46.38851	17	505017	5137217
5030052	52	-80.847388	46.468524	17	511717	5146117
5030053	53	-80.843496	46.463119	17	512017	5145517
5030054	54	-80.840928	46.450516	17	512217	5144117
5030055	55	-80.833165	46.434306	17	512817	5142317
5030056	56	-80.839699	46.425315	17	512317	5141317
5030057	57	-80.846252	46.409125	17	511817	5139517
5030058	58	-80.825544	46.374896	17	513417	5135717
5030059	59	-80.784512	46.228127	17	516617	5119417
5030060	60	-80.723785	46.183896	17	521317	5114517
5030061	61	-80.673656	46.115363	17	525217	5106917
5030062	62	-80.823902	46.48109	17	513517	5147517
5030063	63	-80.818697	46.479282	17	513917	5147317
5030064	64	-80.79003	46.481033	17	516117	5147517
5030065	65	-80.778309	46.480111	17	517017	5147417
5030066	66	-80.758771	46.479171	17	518517	5147317
5030067	67	-80.715833	46.469173	17	521817	5146217
5030068	68	-80.620646	46.484196	17	529117	5147917
5030069	69	-80.530666	46.493762	17	536017	5149017
5030070	70	-80.415015	46.46353	17	544917	5145717
5030071	71	-80.30833	46.454835	17	553117	5144817
5030072	72	-81.042047	46.472152	17	496772	5146510
5030073	73	-81.02549	46.469124	17	498043	5146173
5030074	74	-80.99617	46.47639	17	500294	5146980
5030075	75	-80.9751	46.488267	17	501911	5148300
5030076	76	-80.95157	46.486615	17	503717	5148117
5030077	77	-80.937937	46.490529	17	504763	5148553
5030078	78	-80.914272	46.484142	17	506580	5147845
5030079	79	-80.906162	46.47978	17	507203	5147361
5030080	80	-80.878702	46.485046	17	509310	5147949
5030081	81	-80.858826	46.487516	17	510835	5148226
5030082	82	-80.849308	46.485176	17	511566	5147967
5030083	83	-81.023233	46.490223	17	498217	5148517

Table 29: Sampling Station Coordinates (Latitude & Longitude and UTM)

MOE Station No.	Map Station No.	Longitude	Latitude	Zone	Easting	Northing
5030084	84	-81.008901	46.498325	17	499317	5149417
5030085	85	-80.965886	46.513619	17	502617	5151117
5030086	86	-80.955453	46.519015	17	503417	5151717
5030087	87	-81.069848	46.485125	17	494639	5147953
5030088	88	-81.05812	46.496246	17	495540	5149188
5030089	89	-81.053501	46.516587	17	495896	5151448
5030090	90	-81.090209	46.538361	17	493083	5153870
5030091	91	-81.079331	46.538036	17	493917	5153833
5030092	92	-81.090532	46.560296	17	493061	5156307
5030093	93	-81.095197	46.609183	17	492710	5161740
5030094	94	-81.037188	46.700442	17	497157	5171877
5030095	95	-81.012196	46.838143	17	499070	5187178
5030096	96	-81.060803	46.470677	17	495332	5146347
5030097	97	-81.074882	46.460211	17	494250	5145185
5030098	98	-81.09687	46.448738	17	492560	5143912
5030099	99	-81.110912	46.439134	17	491480	5142846
5030100	100	-81.116236	46.432793	17	491070	5142142
5030101	101	-81.135299	46.419792	17	489603	5140700
5030102	102	-81.24236	46.393579	17	481367	5137807
5030103	103	-81.320863	46.376718	17	475324	5135955
5030104	104	-81.435489	46.355991	17	466496	5133694
5030105	105	-81.537073	46.323124	17	458656	5130090
5030106	106	-81.064173	46.467912	17	495073	5146040
5030107	107	-81.057302	46.461031	17	495600	5145275
5030108	108	-81.048721	46.447815	17	496258	5143806
5030109	109	-81.050542	46.432616	17	496117	5142117
5030110	110	-81.062947	46.409688	17	495162	5139570
5030111	111	-81.06434	46.39949	17	495054	5138437
5030112	112	-81.072564	46.352506	17	494417	5133217
5030113	113	-80.911459	46.314696	17	506817	5129017
5030114	114	-81.089056	46.103194	17	493117	5105517
5030302	302	-80.758463	46.795301	17	518433	5182446
5030303	303	-80.738766	46.83921	17	519920	5187330
5030304	304	-80.651239	46.969111	17	526530	5201791
5030337	337	-80.982424	46.525979	17	501348	5152490
5030338	338	-80.979159	46.539946	17	501598	5154042
5030339	339	-80.985998	46.57122	17	501073	5157517
5030340	340	-81.008198	46.594008	17	499372	5160049
5030341	341	-81.050027	46.594789	17	496168	5160137
5030342	342	-81.094088	46.594707	17	492793	5160131
5030343	343	-81.06828	46.637761	17	494774	5164913
5030344	344	-80.985236	46.638707	17	501130	5165016
5030345	345	-81.009454	46.680753	17	499277	5169688
5030346	346	-80.966848	46.668113	17	502536	5168284
5030347	347	-80.959594	46.648141	17	503092	5166065
5030348	348	-80.979214	46.601125	17	501592	5160840
5030349	349	-80.944917	46.624125	17	504217	5163397
5030350	350	-80.923615	46.650211	17	505845	5166297
5030351	351	-80.911404	46.69366	17	506774	5171126
5030352	352	-80.928502	46.71986	17	505464	5174036
5030353	353	-80.928115	46.75519	17	505490	5177963
5030354	354	-80.871463	46.665166	17	509833	5167964

Table 29: Sampling Station Coordinates (Latitude & Longitude and UTM)

MOE Station No.	Map Station No.	Longitude	Latitude	Zone	Easting	Northing
5030355	355	-80.854355	46.634494	17	511148	5164558
5030356	356	-80.78208	46.686917	17	516664	5170396
5030357	357	-80.801464	46.725361	17	515171	5174664
5030358	358	-80.833427	46.595669	17	512759	5160247
5030359	359	-80.847022	46.585014	17	511720	5159061
5030360	360	-80.885033	46.516266	17	508819	5151417
5030361	361	-80.936396	46.505201	17	504880	5150183
5030362	362	-81.00541	46.516828	17	499585	5151473
5030363	363	-81.032623	46.504386	17	497497	5150091
5030364	364	-81.006681	46.459779	17	499487	5145134
5030365	365	-80.985027	46.449429	17	501150	5143984
5030366	366	-81.009384	46.430449	17	499279	5141875
5030367	367	-81.095081	46.423525	17	492694	5141110
5030368	368	-81.034405	46.458253	17	497358	5144965
5030369	369	-81.030936	46.448868	17	497624	5143922
5030370	370	-81.068641	46.437089	17	494727	5142615
5030371	371	-81.085001	46.393366	17	493465	5137758
5030372	372	-81.115509	46.408963	17	491122	5139494
5030373	373	-81.121953	46.358206	17	490618	5133855
5030374	374	-81.135803	46.381626	17	489557	5136459
5030375	375	-81.159834	46.416946	17	487717	5140387
5030376	376	-81.146902	46.442118	17	488716	5143182
5030377	377	-81.170716	46.455755	17	486890	5144701
5030378	378	-81.012365	46.487093	17	499051	5148169
5030379	379	-81.183094	46.422896	17	485931	5141052
5030380	380	-81.192745	46.447251	17	485196	5143760
5030381	381	-81.20448	46.469226	17	484301	5146204
5030382	382	-81.206849	46.485925	17	484124	5148060
5030383	383	-81.199206	46.512299	17	484718	5150989
5030384	384	-81.161453	46.537656	17	487620	5153800
5030385	385	-81.210914	46.553199	17	483832	5155536
5030386	386	-81.211716	46.601804	17	483785	5160937
5030387	387	-81.220586	46.654532	17	483122	5166798
5030388	388	-81.307861	46.603169	17	476422	5161113
5030389	389	-81.38065	46.587687	17	470839	5159417
5030390	390	-81.455803	46.622447	17	465104	5163310
5030391	391	-81.371879	46.563048	17	471498	5156676
5030392	392	-81.391881	46.530403	17	469947	5153056
5030393	393	-81.310897	46.535881	17	476160	5153637
5030394	394	-81.326283	46.505041	17	474966	5150215
5030395	395	-81.328246	46.465239	17	474797	5145793
5030396	396	-81.328264	46.43788	17	474783	5142753
5030397	397	-81.312532	46.400143	17	475975	5138555
5030398	398	-81.345014	46.329986	17	473444	5130770
5030399	399	-81.345671	46.382669	17	473419	5136624
5030400	400	-81.466824	46.393678	17	464110	5137895
5030401	401	-81.377212	46.409767	17	471008	5139646
5030402	402	-81.388885	46.452153	17	470134	5144360
5030403	403	-81.191131	46.406287	17	485309	5139208
5030404	404	-80.962772	46.434412	17	502860	5142316
5030405	405	-80.91409	46.442495	17	506599	5143217
5030406	406	-80.938396	46.441781	17	504732	5143136

Table 29: Sampling Station Coordinates (Latitude & Longitude and UTM)

MOE Station No.	Map Station No.	Longitude	Latitude	Zone	Easting	Northing
5030407	407	-80.909964	46.44961	17	506915	5144008
5030408	408	-80.889849	46.462048	17	508458	5145392
5030409	409	-80.877153	46.478649	17	509430	5147238
5030410	410	-80.901094	46.494574	17	507590	5149005
5030411	411	-80.958111	46.504158	17	503214	5150066
5030412	412	-80.892744	46.559445	17	508221	5156214
5030413	413	-80.869943	46.579391	17	509965	5158433
5030414	414	-80.852736	46.537864	17	511292	5153821
5030415	415	-80.837147	46.504491	17	512495	5150115
5030416	416	-80.877011	46.495415	17	509438	5149101
5030417	417	-80.815779	46.486882	17	514139	5148162
5030418	418	-80.783241	46.494439	17	516634	5149008
5030419	419	-80.70168	46.518167	17	522883	5151665
5030420	420	-80.629514	46.561505	17	528396	5156504
5030421	421	-80.607924	46.610048	17	530024	5161906
5030422	422	-80.66988	46.665032	17	525254	5167994
5030423	423	-80.781352	46.458697	17	516790	5145037
5030424	424	-80.704502	46.437699	17	522700	5142723
5030425	425	-80.792683	46.437641	17	515926	5142695
5030426	426	-80.749584	46.420258	17	519243	5140773
5030427	427	-80.801	46.394988	17	515299	5137954
5030428	428	-80.982998	46.398796	17	501307	5138358
5030429	429	-81.017497	46.400857	17	498655	5138587
5030430	430	-81.107601	46.337629	17	491719	5131567
5030431	431	-81.139504	46.328595	17	489262	5130567
5030432	432	-81.044824	46.411136	17	496555	5139730
5030433	433	-80.881828	46.419148	17	509081	5140626
5030434	434	-80.865718	46.397936	17	510323	5138271
5030435	435	-80.903216	46.348915	17	507447	5132820
5030436	436	-80.83827	46.345269	17	512445	5132423
5030437	437	-80.777129	46.350782	17	517148	5133047
5030438	438	-80.777931	46.323028	17	517095	5129963
5030439	439	-80.714423	46.315165	17	521987	5129105

APPENDIX B
Figures

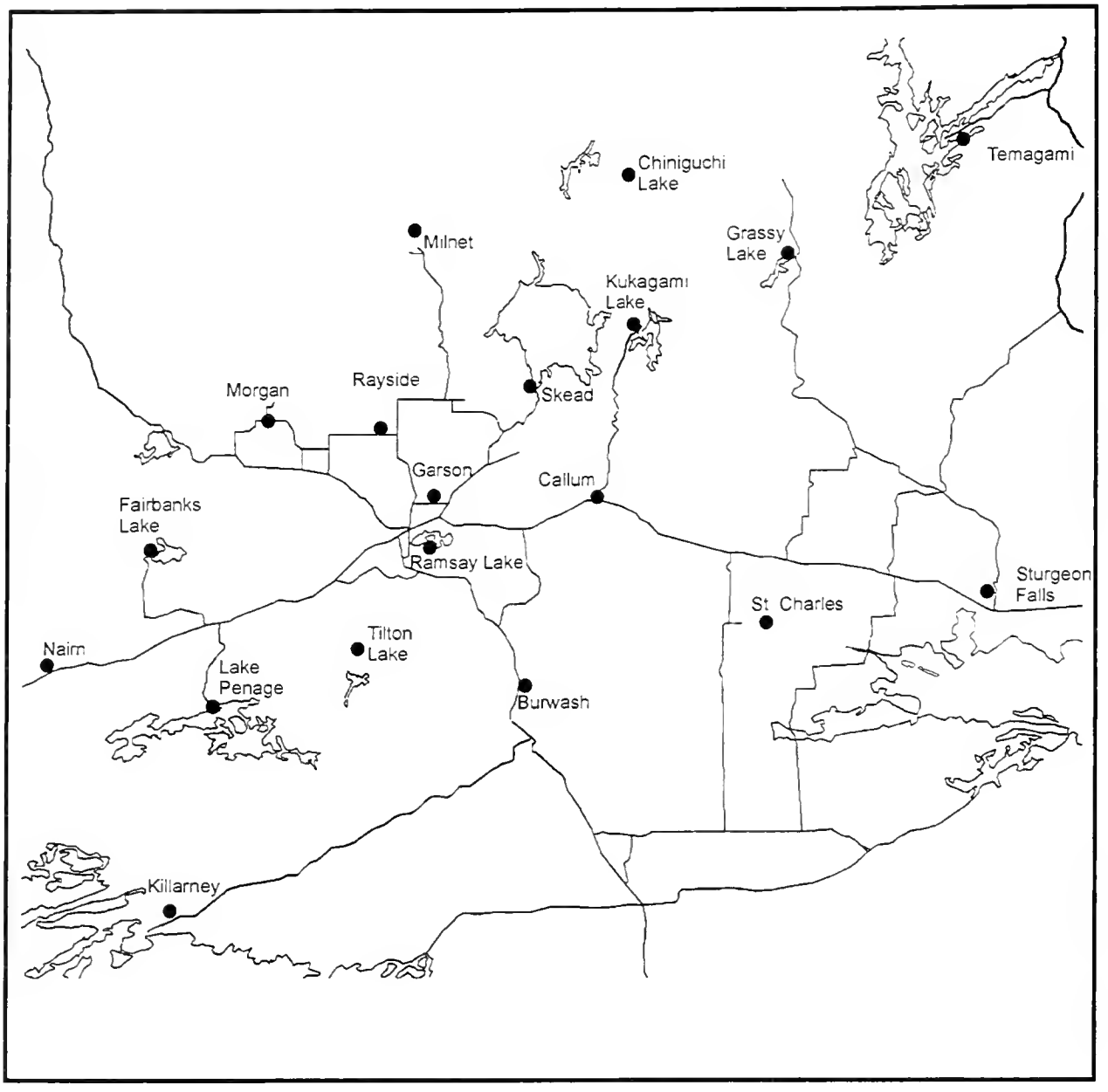
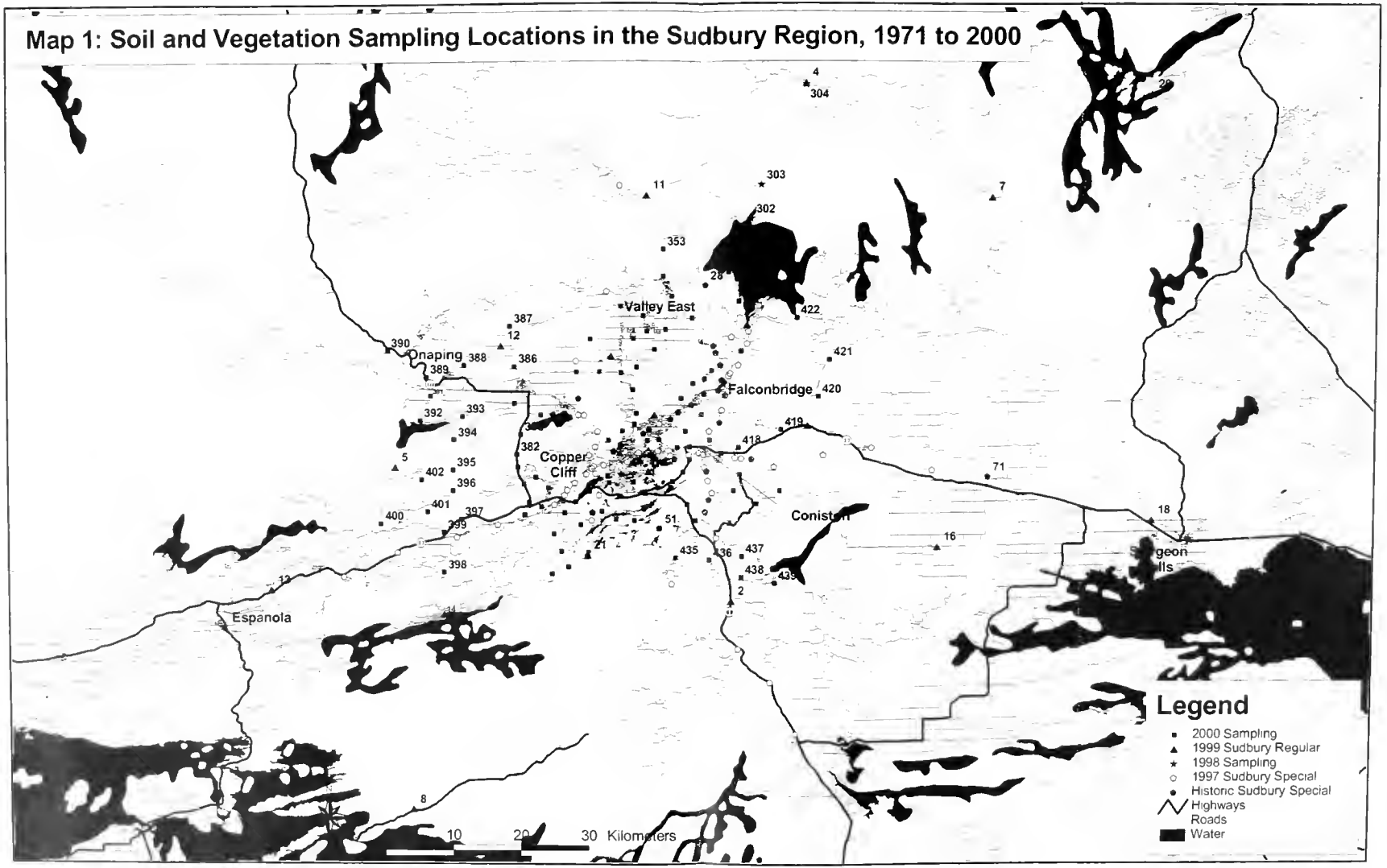


Figure 1. Soil and vegetation sampling locations in the Sudbury area, 1970 to 1999.
* control sites Blind River and Mattawa are beyond the scale of this map.

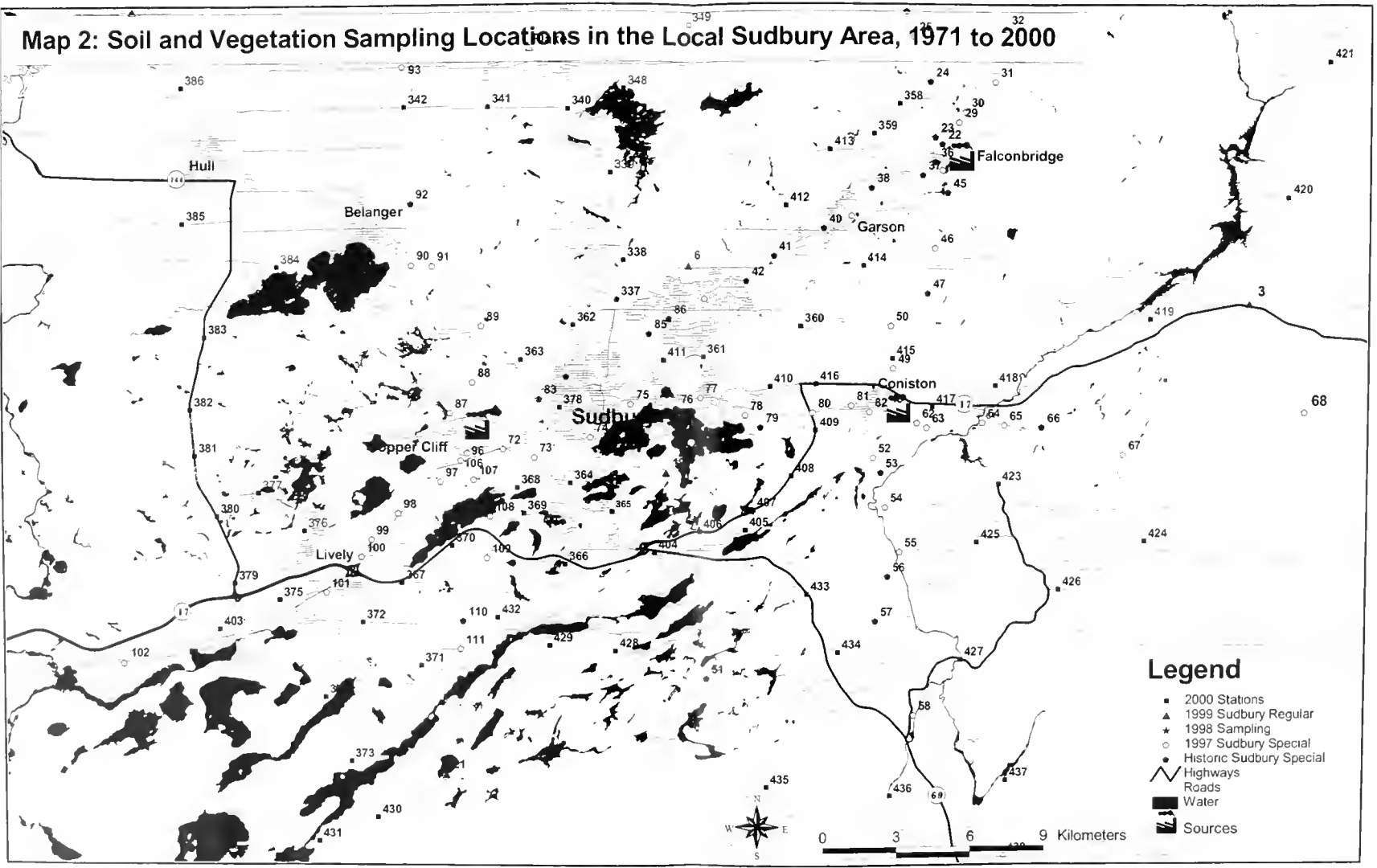
APPENDIX C
Sampling Site Maps

Map 1 identifies the sample sites across the Sudbury region, and illustrates the large size of the study area. Because of the scale of Map 1 some sample sites in the local Sudbury area cannot be numbered. Therefore Map 2 was created so that the sample sites in the City of Greater Sudbury can be identified. In some cases, owing to the large geographic area under study, not all site location numbers were successfully transferred to the maps. However every sampling location is identified in Table 29, the final table in Appendix A, along with its unique geographical coordinates (latitude, longitude and UTM), so that every sampling site can be determined with accuracy (approximately +/- 20 metres).

Map 1: Soil and Vegetation Sampling Locations in the Sudbury Region, 1971 to 2000



Map 2: Soil and Vegetation Sampling Locations in the Local Sudbury Area, 1971 to 2000



APPENDIX D
Changes in Laboratory Practices

A. Sample Preparation

There were four major changes made to the Phytotoxicology sample preparation method since the 1970s.

(i) Prior to 1981, soil samples were collected, air dried, disaggregated with a wooden mallet, and manually sieved through a #45 mesh (approx. 355 μm). If the sample volume was not large enough for analysis, the sieved material was added back to the total sample, the total sample was disaggregated again with the wooden mallet and the entire sample was re-sieved through a #45 mesh until enough volume was obtained.

(ii) In 1981, it was decided to use the standard definition of soils as any material less than 2 mm in diameter. At this time, samples were air dried, disaggregated with a wooden mallet, passed through a ≤ 2 mm sieve and then passed through a #45 mesh (approximately 355 μm). If the sample volume was not large enough for analysis, the sample was not analyzed. The subsequent disaggregation step previously used was discontinued.

(iii) In 1984, the method changed again to include grinding the sample. As before, the samples were air dried, disaggregated, passed through a ≤ 2 mm mesh, and then all of that material was ground to pass through a #45 mesh (approximately 355 μm).

(iv) Vegetation preparation was changed slightly over time. Vegetation samples were originally dried in beakers but over time, the volume collected increased so brown kraft bags were used instead. Also, prior to 1981, samples were ground directly into sample jars and when the jar was filled, the remaining vegetation was not used. Since 1981, the entire vegetation sample was ground to 1 mm into a large plastic bag, the entire sample was re-ground and a sub-sample of that large volume was submitted for analysis.

B. Chemical Analysis

There were four major changes made to the chemical analysis methodology that were implemented by the Ministry of the Environment as of May 1984.

(i) For inorganic chemical analysis of soils, acid digestion in beakers on hotplates was replaced with samples in test tubes in a hot block. This allowed for more uniform and thorough heating during the digestion process, thereby improving precision.

(ii) Prior to 1983, the Atomic Adsorption Spectrophotometry (AAS) method was used for analysis (with perchloric/nitric digestion). Once the Inductively Coupled Argon Plasma Atomic Emission Spectroscopy (ICP-AES) machine had been acquired, both were used for metals analysis throughout 1983. For requests of 5 or less elements, or for special request elements, the AAS was used. If a metals scan was requested (a scan of 20+ metals), the ICP-AES was used. LSB used these two methods interchangeably and felt that they provided results of similar accuracy. However, ICP-AES allows for the analysis of more metals simultaneously while utilizing less sample volume and reagent and hence more sample results were available in a shorter period of time.

(iii) The perchloric/nitric acid combination was replaced with hydrochloric/nitric acid for the ICP-AES method. The use of perchloric acid in AAS allowed for more efficient digestion; however, its use in the ICP-AES machine caused interferences and problems with sample nebulization. Therefore, sample recovery may have decreased slightly when hydrochloric/nitric (aqua regia) was adopted due to less thorough sample digestion.

(iv) Soil sample weight/volume of acid ratios were also changed at the same time. Soils changed from 1.0 g/25 mL to 0.5 g/25 mL and vegetation changed from 1.0 g/10 mL to 0.5 g/10 mL. This was done in an effort to reduce the amounts of dissolved solids in the sample and allowed for "streamlining" of the digestion procedures. Due to better detection limits offered by ICP-AES, the change in volume resulted in a negligible difference.

Appendix E
Derivation and Significance of the MOE Soil Remediation Criteria (Clean-up Guidelines)

The MOE soil clean-up *Guidelines* have been developed to provide guidance for cleaning up contaminated soil. The *Guidelines* are not legislated Regulations. Also, the *Guidelines* are not action levels, in that an exceedence does not automatically mean that a clean-up must be conducted. The *Guidelines* were prepared to help industrial property owners decide how to clean-up contaminated soil when property is sold and/or the land-use changes. Most municipalities insist that contaminated soil is cleaned up according to the MOE *Guidelines* before they will approve a zoning change for redevelopment, therefore, even though the *Guideline* is voluntary most industrial property owners and developers are obliged to use it. For example, the owner of an industrial property who plans to sell the land to a developer who intends to build residential housing can use the *Guideline* to clean up the soil to meet the residential land-use criteria. In this way previously-contaminated industrial land can be re-used for residential housing without concern for adverse environmental effects.

The *Guideline* contains a series of Tables (A through F), each having criteria for soil texture, soil depth, and ground water use for various land-use categories (eg, agricultural, residential, industrial). Table F *criteria* reflect the upper range of background concentrations for soil in Ontario. An exceedence of Table F indicates the likely presence of a contaminant source. Tables A through E *criteria* are effects-based and are set to protect against the potential for adverse effects to human health, ecological health, and the natural environment, whichever is the most sensitive. By protecting the most sensitive parameter the rest of the environment is protected by default. The *Guideline criteria* take into consideration the potential for adverse effects through direct contact, and through contaminant transfer from soil to indoor air, from ground water or surface water through release of volatile gases, from leaching of contaminants in soil to ground water, or from ground water discharge to surface water. However, the *Guideline criteria* ***may not*** ensure that corrosive, explosive, or unstable soil conditions will be eliminated.

If the decision is made that remedial action is needed, the *criteria* in Tables A to F of the *Guideline* can be used as clean-up targets. In some cases, because of economic or practical reasons, it may not be possible to clean up a site using the generic *criteria* in Tables A to F. The *Guideline* provides a process, called a *site specific risk assessment*, which is used to evaluate the soil contamination with respect to conditions that are unique to the contaminated site. In a *site specific risk assessment* the proponent examines all the potential pathways through which the contamination may impact the environment and must demonstrate that because of conditions unique to that site the environment and human health will not be adversely affected if contamination above the generic *criteria* in Table A to E is left in place.

When contamination is present and a change in land-use is not planned, for example residential properties and public green spaces near a pollution source, the *Guideline* may be used in making decisions about the need for remediation. This is different from the previously described situation where a company that caused contamination on their own property decides to clean up the

soil, usually at the insistence of the municipality who will not approve a zoning change unless remediation is conducted. Decisions on the need to undertake remedial action when the *Guideline criteria* are exceeded ***and*** where the land-use is not changing are made on a site by site basis using *site specific risk assessment* principals and are usually contingent on the contaminants having caused an adverse environmental effect or there is a demonstrated likelihood that the contamination may cause an adverse effect. Because of the long history of industrial operation and our practice of living close to our work place the soil in many communities in Ontario is contaminated above the effects-based *criteria* in the MOE *Guidelines*. In practice, remediation of contaminated soil on privately-owned residential property and public green spaces has only been conducted in communities when the potential for adverse health effects has been demonstrated.

The soil clean-up *Guidelines* were developed from published U.S. EPA and Ontario environmental data bases. Currently there are criteria for about 25 inorganic elements and about 90 organic compounds. Criteria were developed only if there were sufficient, defendable, effects-based data on the potential to cause an adverse effect. All of the criteria address human health and aquatic toxicity, but terrestrial ecological toxicity information was not available for all elements or compounds. The development of these clean-up *Guidelines* is a continuous program, and criteria for more elements and compounds will be developed as additional environmental data become available. Similarly, new information could result in future modifications to the existing *Guidelines*.

For more information on the MOE's soil clean-up *Guidelines* please refer to the *Guideline for Use at Contaminated Sites in Ontario. Revised February 1997*, Ontario Ministry of Environment and Energy, PIBs 3161E01, ISBN 0-7778-6114-3. This document is also available on the MOE web site at www.ene.gov.on.ca, look on the main page under the heading *Contaminated Sites: Clean-up Guideline* and follow the links to *Publications*.

Appendix F
Derivation and Significance of the MOE "Ontario Typical Range" Soil Guidelines

The MOE "Ontario Typical Range" (OTR) guidelines are being developed to assist in interpreting analytical data and evaluating source-related impacts on the terrestrial environment. The OTRs are used to determine if the level of a chemical parameter in soil, plants, moss bags, or snow is significantly greater than the normal background range. An exceedence of the OTR_{98} (the OTR_{98} is the actual guideline number) may indicate the presence of a potential point source of contamination.

The OTR_{98} represents the expected range of concentrations of chemical parameters in surface soil, plants, moss bags, and snow from areas in Ontario not subjected to the influence of known point sources of pollution. The OTR_{98} represents 97.5 percent of the data in the OTR distribution. This is equivalent to the mean plus two standard deviations, which is similar to the previous MOE "Upper Limit of Normal" (ULN) guidelines. In other words, 98 out of every 100 background samples should be lower than the OTR_{98}.

The OTR_{98} may vary between land use categories even in the absence of a point source of pollution because of natural variation and the amount and type of human activity, both past and present. Therefore, OTRs are being developed for several land use categories. The three main land use categories are Rural, New Urban, and Old Urban. Urban is defined as an area that has municipal water and sewage services. Old Urban is any area that has been developed as an urban area for more than 40 years - New Urban, developed for under 40 years. Rural is all other areas. These major land use categories are further broken into three subcategories; Parkland (which includes greenbelts and woodlands), Residential, and Industrial (which includes heavy industry, commercial properties such as malls, and transportation rights-of-way). Rural also includes an Agricultural category.

The OTR guidelines apply only to samples collected using standard MOE sampling, sample preparation, and analytical protocols. Because the background data were collected in Ontario, the OTRs represent Ontario environmental conditions.

The OTRs are not the only means by which results are interpreted. Data interpretation should involve reviewing results from control samples, examining all the survey data for evidence of a pattern of contamination relative to the suspected source, and where available, comparison with effects-based guidelines. The OTRs are particularly useful where there is uncertainty regarding local background concentrations and/or insufficient samples were collected to determine a contamination gradient. OTRs are also used to determine where in the anticipated range a result falls. This can identify a potential concern even when a result falls within the guideline. For example, if all of the results from a survey are close to the OTR_{98} this could indicate that the local environment has been contaminated above the anticipated average, and therefore the pollution source should be more closely monitored.

The OTRs identify a range of chemical parameters resulting from natural variation and

normal human activity. As a result, it must be stressed that values falling within a specific OTR98 should not be considered as acceptable or desirable levels; nor does the OTR_{98} imply toxicity to plants, animals or humans. Rather, the OTR_{98} is a level which, if exceeded, prompts further investigation on a case by case basis to determine the significance, if any, of the above normal concentration. Incidental, isolated or spurious exceedences of an OTR_{98} do not necessarily indicate a need for regulatory or abatement activity. However, repeated and/or extensive exceedences of an OTR_{98} that appears to be related to a potential pollution source does indicate the need for a thorough evaluation of the regulatory or abatement program.

The OTR_{98} supersedes the Phytotoxicology ULN guideline. The OTR program is on-going. The number of OTRs will be continuously updated as sampling is completed for the various land use categories and sample types. For more information on these guidelines please refer to Ontario Typical Range of Chemical Parameters in Soil, Vegetation, Moss Bags, and Snow, MOEE Report Number HCB-151-3512-93, PIBs Number 2792, ISBN 0-778-1979-1.

APPENDIX G

Derivation and Significance of the "Upper Limits of Normal" Contaminant Guidelines.

The MOE Upper Limits of Normal (ULN) contaminant guidelines represent the expected maximum concentration in surface soil, foliage (trees and shrubs), grass, moss bags, and snow from areas in Ontario not exposed to the influence of a pollution source. Urban ULN guidelines are based on samples collected from urban centers, whereas rural ULN guidelines were developed from non-urbanized areas. Samples were collected by Phytotoxicology staff using standard sampling procedures (reference: Ontario Ministry of the Environment. 1989. Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples. Phytotoxicology Section, Air Resources Branch: Technical Support Sections NE and NW Regions, Report No. ARB-138-88-Phyto. ISBN: 0-7729-5143-8.). Chemical analyses were conducted by the MOE Laboratory Services Branch.

The ULN is the arithmetic mean plus three standard deviations of the suitable background data for each chemical element and parameter. This represents 99% of the sample population. This means that for every 100 samples that have not been exposed to a pollution source, 99 will fall within the ULN.

The ULNs do not represent maximum desirable or allowable limits. Rather, they are an indication that concentrations that exceed the ULN may be the result of contamination from a pollution source. Concentrations that exceed the ULNs are not necessarily toxic to plants, animals, or people. Concentrations that are below the ULNs are not known to be toxic.

ULNs are not available for all elements. This is because some elements have a very large range in the natural environment and the ULN, calculated as the mean plus three standard deviations, would be unrealistically high. Also, for some elements, insufficient background data is available to confidently calculate ULNs. The MOE Phytotoxicology ULNs are constantly being reviewed as the background environmental data base is expanded. This will result in more ULNs being established and may amend existing ULNs.

For more information on these guidelines please refer to Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples, MOEE Report Number ARB-138-88-Phyto, ISBN 0-7729-5143-8.

APPENDIX H

Table H-1:

Ministry of the Environment Guideline Concentrations for Selected Metals in Soil.

Element	Table F	Table A	OTR_{98}
Aluminum (Al)	--	--	30000
Arsenic (As)	17	20	--
Barium (Ba)	210	750	--
Beryllium (Be)	1.2	1.2	--
Calcium (Ca)	--	--	55000
Cadmium (Cd)	1	12	--
Cobalt (Co)	21	40	--
Chromium (Cr)	71	750	--
Copper (Cu)	85	225	--
Iron (Fe)	--	--	35000
Magnesium (Mg)	--	--	20000
Manganese (Mn)	--	--	2200
Molybdenum (Mo)	2.5	40	--
Nickel (Ni)	43	150	--
Lead (Pb)	120	200	--
Selenium (Se)	1.9	10	--
Strontium (Sr)	--	--	64
Sulphur (S)	--	--	0.079
Vanadium (V)	91	200	--
Zinc (Zn)	160	600	--

Sulphur data are presented as a percentage. All other data are presented as dry weight concentrations in µg/g. Table F values represent background concentrations expected in Ontario for all other land uses than agriculture. (See Appendix E). – – = OTR_{98} values are used where Table F values do not exist, especially for elements that are also nutrients (i.e., calcium and magnesium) (See Appendix F). Table A values are effects based guidelines that are based on the most sensitive receptors within the residential/parkland land use classification (See Appendix E).

Table H-2:
Ministry of the Environment Guideline Upper Limit of Normal (ULN) Concentrations for Selected Metals in Tree Foliage and Forage.

Element	Tree Foliage	Forage
Aluminum (Al)	500	NG
Arsenic (As)	2	8
Barium (Ba)	NG	NG
Boron (B)	75	20
Beryllium (Be)	NG	NG
Calcium (Ca)	30000	NG
Cadmium (Cd)	1	2
Chlorine (Cl)	0.15%	1
Cobalt (Co)	2	8
Chromium (Cr)	8	5
Copper (Cu)	20	20
Iron (Fe)	500	500
Potassium (K)	NG	NG
Magnesium (Mg)	7000	NG
Manganese (Mn)	NG	NG
Molybdenum (Mo)	1.5	6
Nickel (Ni)	30	25
Lead (Pb)	30	20
Selenium (Se)	0.5	0.5
Strontium (Sr)	NG	NG
Sulphur (S)	0.4	0.5
Vanadium (V)	5	6
Zinc (Zn)	250	100

Chlorine and sulphur data are presented as a percentage. All other data are presented as dry weight concentrations in µg/g. Upper Limit of Normal concentrations for both tree foliage and forage are based on unwashed samples from rural areas. NG = no guideline has been established for that element